

AG 105

.M78

Copy 1

THE HANDY CYCLOPEDIA OF COMMON THINGS

AND BIOGRAPHICAL DICTIONARY





Class AG 145

Book .1478

Copyright N^o _____

COPYRIGHT DEPOSIT.

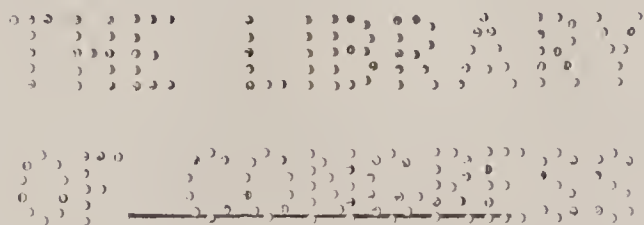


THE EIFFEL TOWER—A MARVEL OF ENGINEERING

Erected for the Paris Exposition of 1889, the tower was also an attraction at the Exposition of 1900. It is built of metallic piers in viaducts, and is 984 feet high. The iron used in its construction weighs 7,300 tons.

The Handy Cyclopedia
—OF—
COMMON THINGS
And Biographical Dictionary

EDITED BY
Prof. CHARLES MORRIS, LL.D.



PROFUSELY ILLUSTRATED

THE LIBRARY OF
CONGRESS,
TWO COPIES RECEIVED
SEP. 5 1901
COPYRIGHT ENTRY
Aug. 30. 1901
CLASS *a* XXc. No.
15945
COPY B.

AG105
M 78

Entered according to Act of Congress in the year 1901, by
W. E. SCULL,
in the office of the Librarian of Congress, at Washington

ALL RIGHTS RESERVED



W. E. SCULL
1901

71 m 11. sep 1913

ENCYCLOPEDIC DICTIONARY

OF

COMMON THINGS

AND OTHER USEFUL INFORMATION

Abdo'men. [L. *abdomen*.] In the human body the trunk is divided by the diaphragm into two cavities—the upper being the thorax or chest, and the lower the abdomen or belly. The abdomen contains the stomach, liver, intestines, spleen, pancreas, kidneys, etc. It is lined by a serous membrane, which is folded over the organs, and allows them a certain freedom of movement, but keeps them in their proper relations to each other. (See *Bowels*.)

Aca'cia. A genus of plants of the Pulse family, including the catechu and gum-arabic trees. The

species are numerous, are frequently thorny, and grow mostly in warm countries. Nearly 300 species are Australian or Polynesian and have vertically compressed leaf-stalks, instead of the bipinnate leaves of the much fewer species of Africa, etc. Very few are found in temperate climates, but many are cultivated in greenhouses for the sake of their flowers, which are of great beauty and often fragrant.



The North American locust tree and other species of robinia are often called acacia in the United States and Europe, but wrongly.

Accord'ion. A small musical instrument, with keys and bellows, the tones of which are produced by the vibration of metallic springs, occasioned by a current of air rushing from the bellows through valves attached to the keys, and opened by the fingers of the player.

Ace'tic Acid. [L. *acetum*, vinegar; *acidus*, sour.]

The most common of the vegetable acids, familiar to all as the sour principle in vinegar. It occurs in the juice of many plants, and in some animal secretions; but on the large scale it is prepared from damaged wines, by the fermentation of malt, or by the destructive distillation of wood. Pure acetic acid is prepared by the dry distillation of wood. The pure acid has a sour taste and a pungent smell, is poisonous, and burns the skin. In the arts it is used as a mordant in calico-printing, and in the preparation of certain varnishes. It is also used as a condiment and in medicine. The salts of acetic acid are called acetates, the most important of them being acetate or sugar of lead.

Acet'ylene. [L. *acetum*, vinegar.] A substance

composed of carbon and hydrogen and of remarkable powers. It is not a new discovery but has only lately been produced in large quantities from carbide of calcium, a product of the electric furnace. When water is thrown on this substance it gives off acetylene gas. It was found about 1895, that this gas, when burned in a suitable burner, would give the brightest light of any known gas. When placed under strong pressure acetylene becomes a liquid, and the gas which arises from this is burned in suitable lamps, yielding a light twelve times as bright as that of ordinary coal gas. But this new light has not come into much use, for there is danger of explosion. Acetylene has other uses, for a great many chemical substances can be made from it, belonging to what are called the hydrocarbons.

Achromat'ic. [Gk. *achromatos*, colorless.] Free from color (applied to lenses, telescopes and microscopes); transmitting light without decomposing it into its primary colors.—*Achromatic lens*, a combination of two dissimilar substances, as crown and flint glass, so arranged that the chromatic aberration produced by the one is corrected by the other, and light passes undecomposed.

Ac'id. [L. *acidus*, sour.] A general term used in chemistry to designate a special group of substances, mostly, but not always, oxygen compounds. The chief distinguishing property of acids, and one which is common to all of them, is that of combining with bases to form salts. They are also distinguished by their *sour* or *acid* taste, and by the power of turning blue vegetable colors into red. These blue colors are litmus, syrup of violets or of radishes. When these blues have been changed into green by an alkali, their color is restored by an acid.

A'corn. [AS. *æcern*, from *æcer*, a field.] The seed or fruit of the oak, growing in a woody cup. Acorns contain starch and oil, and generally have a bitter taste. They are eaten freely by swine, while the fruit of some species are sweet and nutritious and are eaten by man. The oil has been used in cookery and for other purposes.

Ad'der. [AS.] A name often applied to the common viper, as well as to other kinds of venomous reptiles or serpents. In North America the term *adder* is commonly applied to several harmless snakes.

Adult'eration. [L. *adulteratio*, corruption.] The mixing of foreign substances with articles of food and drugs, of water with milk, etc., for the purpose of defrauding customers. This is a very common practice, and often renders drugs useless and food injurious, if not poisonous. Many laws have been passed to check it, but not with full effect.

Aeo'lian Harp. [L. *Æolus*, the god of the wind.] A box of very thin wood, with strings of catgut or other vibratory material stretched across it, and sounding holes cut in the top. When placed in a current of air, as in a window between the raised sash and the sill, it yields a music sweet in tone, but usually sad in character.

A'erolite. [Gk. *aer*, air, and *lithos*, a stone.] A meteoric stone that comes into the atmosphere

from space and falls to the earth. It is of the same nature as the shooting stars, small particles, which become so hot from friction with the atmosphere that they are burned up. Aerolites are very hot when they first fall. They are largely made up of pure iron,

but contain also nickel, silicon, and other elements. Some very large ones have been found weighing many hundreds of pounds.

Af'terglow. The brilliant twilight colors often seen after sunset. These are of red and yellow tints and sometimes are very lasting. If seen before sunset they are called **foreglows**.

Ag'ate. [L. *achates*; so called from the name of the river Achates in Sicily, where it was first found.] A variety of quartz, found in loose rounded pieces in rocks, or as loose pebbles in beds of rivers or gravel. Wood may be converted

into agate by infiltration with waters carrying silica in solution, as in the celebrated petrified forest of Arizona. Agates show various tints in the same specimen, and the colors are delicately arranged in stripes or bands, or blended in clouds. They take a fine polish, and are much used in the manufacture of rings, seals, beads, handles of knives and forks, cups, smelling bottles, and many other ornamental articles. Burnishers for polishing, used by bookbinders, are made of agate.

Aga've. The name of a genus of plants growing in tropical America. The principal species is known as the American Aloe, or century plant, under the idea that it blooms but once in a hundred years. This is a mistake, its period of blooming being about ten years. It is called *maguey* by the Mexicans, who distil from its sap an intoxicating drink. The coarse thread called sisal hemp is made from the fibres of its leaves.

A'gue. [L. *acutus*, sharp.] An intermittent fever, consisting of hot and cold stages in succession, with an intermediate period. It comes on at fixed periods, one, two, three, or more days apart. It is now generally known as malarial fever. Long supposed to be due to marsh miasma, it is now traced to a bacterial germ, and there is much reason to believe that the mosquito is the carrier of this germ, which it injects into man with its bite.

Air. [Fr., from Gk. *aer*, air; *aein*, to blow.] The gaseous fluid which we breathe and which surrounds the earth. It is a mixture of oxygen and nitrogen, with a small amount of carbon dioxide, the average proportions being, by volume: oxygen, 20.96 per cent.; nitrogen, 79.00 per cent.; carbon dioxide, 0.04 per cent. (See *Atmosphere*; *Compressed Air*; *Liquid Air*.)

Air Bladder or Swim Bladder. A membranous sac found in most fish, which contains a quantity of gas, and is thought to help the fish to rise and sink in the water. It is very small in some fish, quite large in others, and wanting in sharks and some other fish. In some cases it is converted into a sort of lung and is used as a breathing organ.

Air-brake. A brake now used on railroad cars and engines, invented in 1869, by George Westinghouse, of Pittsburg. Air is compressed by the steam of the engine boiler, and carried in tubes to the car wheels, where it exerts its pressure on the brakes when it is desired to stop the train. (See *Brake*.)

Air-gun. A gun which uses compressed air instead of gunpowder to drive out the bullet. There is a piston to force the air into a cavity, and a valve opened by the trigger, which lets the air out against the bullet. This is driven out with some force. Air guns are of little use.

Air-pump. An instrument for the withdrawal of air from a closed vessel, producing an empty space or vacuum; in ordinary air-pumps the vacuum is very far from complete, and in the most perfect of them some air remains. Many interesting experiments may be performed in the exhausted receiver of an air-pump, such as the boiling of water at a much lower than the



usual temperature, and the extinguishing of a candle, a proof that air is necessary to combustion.

Al'abaster. [Gk. *alabastros*.] A fine grained whitish limestone or marble. It is of two kinds, one of which is a carbonate of lime, the other a sulphate of lime or gypsum, and to the latter the term is now generally applied. It is carved into vases, mantel ornaments, statuettes, etc.

Al'batross. [Span.] A genus of large, web-footed, aquatic birds, allied to the gulls. They are the largest of sea-birds, capable of long-continued flight, and are often seen hundreds of miles from land. They are found chiefly in the southern hemisphere.

Albu'men or Albu'min. [L. *albus*, white.] A nutritive substance found in animals; also a supply of nourishing matter within the integuments of the seed in many plants, external to the embryo or germ in some, and within it in others. It is the floury part in wheat and other grains, and is a very important part of food. Albumen exists in many of the solids and fluids of the animal body, also in many plants. It occurs in its purest form in the white of an egg, and in the serous or liquid portion of the blood. It is a yellowish, transparent, gum-like substance, soluble in cold water. One of the most characteristic properties of a solution of albumen is its power of coagulation. If a solution be heated to about 70°, it becomes solid and opaque, and in this state it is insoluble in water, but dissolves in dilute alkalies.

Al'chemy. [Ar. *Alkimia*.] A pretended art arising from chemistry, by which it is sought to make gold or silver out of baser materials, or to produce a universal medicine. The conversion into gold was to be effected by what was called the *philosophers' stone*. Alchemy was practiced for many centuries, but its only important result was the discovery of various chemical elements, such as sulphuric, nitric and muriatic acids.

Al'cohol. [Fr., from Arab.] A volatile organic substance produced during the fermentation of vegetable juices which contain sugar. It is a colorless, limpid liquid, possessing an agreeable smell and burning taste; is very inflammable, and burns with a bluish flame. It is used for thermometers in measuring low temperatures, and can be employed down to -39 F. It is prepared from spirituous liquors by successive distillations. The alcohol being more volatile than water, comes off first; but it cannot be entirely separated from water by this process, since the strongest spirit so obtained contains 10 per cent. of water. To obtain pure alcohol, this water has to be removed by distilling the spirit with some substance capable of combining with water, such as quicklime or potassium carbonate. To the chemist alcohol is very useful as a solvent, and in medicine as a solvent and antiseptic agent. It is the alcohol in spirits, wines, and malt liquors to which the intoxicating effects of these beverages are due. In chemistry the term alcohols is applied to a considerable number of liquids

which resemble ordinary alcohol in certain chemical reactions, and include methyl, propyl, and various other compounds.

Al'der. [AS. *alr* or *aler*, L. *alnus*.] A genus of plants, consisting of trees and shrubs, growing chiefly in moist soils. The wood is used by turners, and is very valuable for mill-wheels and other wood-work under water. It affords the best kinds of charcoal for making gunpowder, and its bark is used by dyers and tanners.

Ale. [AS.] A liquor made from an infusion of pale malted barley by fermentation with a bitter, usually hops. (See *Beer*.)

Al'gebra. [Arab. *al-jabr*, reduction of parts to a whole.] A sort of universal arithmetic, in which the unknown terms are expressed by letters of the alphabet, and dealt with as if known. By this means very intricate problems can be solved, which would be impossible with ordinary figures. In the higher mathematics algebra is of extreme importance.

Aliz'arine. [Fr. *alizarine*.] A peculiar coloring principle obtained from madder, and now produced artificially from the coal-tar product anthracene. It is the coloring matter used in the dyeing of Turkey red.

Al'kali. [Arab.] The name applied in chemistry to a class of bodies possessing the following common properties:—(1) They have the power of turning vegetable blue colors green, and vegetable yellows brown; (2) they restore the color to a blue solution which has been reddened by an acid; (3) they have a strong affinity for acids, combining with them to form salts which possess neither acid nor alkaline properties—hence an acid and an alkali are said to neutralize one another; (4) they are all soluble in water. The alkalies proper are four in number—potash, soda, lithia and ammonia. They exert a powerfully corrosive action on animal and vegetable substances. As bicarbonates they are often used along with carbonic acid to correct acidity of the stomach.



Al'ligator. [Span. *el legarto*, the lizard.] A large American reptile of the Crocodile family. It has a shorter and broader snout than the crocodile, and the large teeth of the lower jaw fit into pits

in the edge of the upper jaw, which has no notches. Alligators vary in length from 2 to 20 feet, the head being about one-seventh of the entire length. They embrace three genera, the alligator, abundant in Florida, and the caiman and jacare, found in tropical South America. The caiman is also found in Mexico. Their principal food is fish, but they catch and devour land animals, as the sheep and pig, and sometimes even men. An alligator lays from 50 to 60 large eggs in a hollow in the mud, covered over with grass and reeds, and leaves them to be hatched by the sun. The young take to the water as soon as hatched, being carefully tended by the mother alligator. The skin when tanned makes good leather for boots and shoes.

Alloys'. [Fr. *a loi*, from L. *ad legem*, according to rule.] The name given to the mixtures which result from fusing different metals with each other. Both gold and silver when pure are too soft for the manufacture of plate, coin, or jewelry; but when mixed with a small percentage of copper, they are rendered harder and more durable, without suffering any loss in color. One of the most useful alloys in the arts is brass. It consists of zinc and copper, and the proportion of each metal in the compound is regulated to suit the quality of the brass required. Among the important alloys of copper and tin are (1) bronze, containing 90 parts of copper and 10 of tin; (2) bell-metal, containing 80 parts of copper and 20 of tin; (3) speculum-metal, containing 67 parts of copper and 33 of tin. Type-metal varies somewhat in its composition; one variety consists of 80 parts of lead and 20 of antimony. Aluminium-bronze and nickel-steel are important recent alloys. The alloys of other metals with mercury are termed *amalgams*, and the process of amalgamation has long been employed in separating fine gold from other materials.

All'spice. From a tree of the Myrtle tribe, a native of the West Indies, allspice, or Jamaica pepper, is obtained. Allspice is the dried berry; it is so called because it is considered to have the flavor of cloves, cinnamon, and nutmeg combined. It is mildly pungent and agreeably aromatic.

Al'manac. A book or pamphlet telling the divisions of the year into months, weeks, and days, the times of rising and setting of the sun and moon, movements of the tides, eclipses, and other information about the earth and the stars. Almanacs formerly pretended to foretell the weather, but only ignorant persons believed this. Almanacs are now published giving many facts of official and other kinds. "Poor Richard's Almanack," published by Benjamin Franklin in 1732, is a well-known and interesting almanac. It was published for 25 years and was filled with wise and pithy sayings, inculcating industry and frugality as helps to virtue.

Al'mond. [Fr., from Gk. *amygdalon*.] The fruit of the almond tree, a native of the East and of Africa, grown in the countries around the Mediterranean, and of late years produced in large quantities in California. The fruit or nut is covered with a hard green shell, which dries as it

ripens, and finally bursts open and lets the almond drop out. The principal varieties in cultivation are the sweet, bitter, thin-shelled, thick-shelled, and Jordan almonds. Sweet almonds are used in confectionery and for dessert. They contain a large quantity of a bland fixed oil, are of a very agreeable taste, and very nutritious. Bitter almonds contain a substance called amygdalin, from which a peculiar volatile oil is obtained. The Jordan almonds, brought from Malaga, are the finest. Almond wood is a very hard, dense wood, something like *lignum vitæ*. It is used for the teeth and bearings of wooden cog-wheels.

Al'oe. [L. *aloe*.] A genus of succulent trees and shrubs of many species, but the greater number having the habit and appearance of evergreen herbaceous plants. They are natives of warm climates, and flower only once, after a growth of from fifty to one hundred years. The fibres of the leaves are manufactured into thread, cords, and nets, and stockings are woven from the fibres of a species found in Jamaica. But aloes are chiefly valuable for their medicinal properties, the drug called aloes being obtained from the juice of several species.

Alpac'a. An animal of Peru, having long, fine, woolly hair; a species of llama (*q. v.*). The thin cloth called alpaca is woven out of alpaca wool, mixed with silk or cotton.

Al'phabet. [Gk. *Alpha* and *Beta*, the first two letters of the Greek alphabet.] The name given to the series of letters of which the words of any language are made up. Alphabets are very ancient, and every civilized nation has one of its own. In the Hebrew there are letters for the consonants only. Some alphabets have a letter for each syllable, and the Chinese have a character for every word. The English alphabet has twenty-six letters. Some have fewer and some more, the Russian having thirty-six.

Al'um. [L. *alumen*.] A white saline compound used in dyeing and many other industrial processes. Chemically it is known as a double sulphate of potassium and aluminium. It has an astringent and sweetish taste, turns vegetable blue colors red, dissolves in water and melts when heated. When more strongly heated it loses its water of crystallization, leaving the white substance known as burnt alum, which is used as a caustic. It has many highly important uses in the arts, as a mordant in dyeing, etc., and in medicine it is of great use as an astringent in stopping bleeding. Wood and paper which have been dipped in a solution of alum are less liable to catch fire.

Alumin'ium. [L. *alumen*.] A white metal, somewhat like silver in appearance. It occurs chemically combined in all the older rocks and in clay. It is very malleable, and therefore capable of being hammered into thin sheets or drawn into fine wire. Being highly sonorous, it is a suitable substance for bells. It is very light, being only $2\frac{1}{2}$ times heavier than water, and therefore 4 times lighter than silver. It melts

when heated to redness, and has no action on water at ordinary temperatures. On account of its bright lustre, hardness, and malleability, it is largely used for jewelry, for balance beams, and in making sextants and other astronomical instruments, and on account of its lightness for many other purposes. It forms alloys with most of the metals. It was first discovered in 1828, and was not produced in commercial quantities until 1855. It is now cheaply produced by electricity.

Amal'gam. [Fr., from Gk. *malagma*, a plaster.] An alloy of mercury with another metal or metals. Amalgams are largely made use of in the arts. Metals are sometimes gilded by washing them with an amalgam of gold and mercury; the mercury is then driven off by heat, leaving the gold on the metal.

Am'ber. [Arab]. A hard, yellow, translucent resin, found as a fossil in beds of lignite, in alluvial soils, and on sea-coasts, especially the Prussian coast of the Baltic. It takes a fine polish, and is much used for making ornaments, such as necklaces, earrings, pendants, and beads; for the mouth-pieces of pipes and cigar-holders, and for burning for perfume. It is also used as a basis for a fine varnish. By friction it becomes strongly electric.

Am'bergris. [Fr. *ambre gris*, gray amber.] A substance found floating in the sea or thrown upon the coasts in warm climates, and also in the intestines of the sperm whale, which is believed to be in all cases its true origin. The floating masses are sometimes from 60 to 250 lbs. in weight. In color it is gray, yellow, white, or black, and often variegated like marble. It is much used in perfumery, and to improve the flavor of wines and cordials. In Asia and Africa it is used as a medicine, also as a condiment in cooking.

Am'ethyst. [L. *amethystus*, from Gk. *amethystos*, without drunkenness, because the ancients believed that liquor drunk out of cups made of amethyst would not intoxicate.] A variety of rock-crystal or quartz, of a purple or bluish-violet color, much used as a precious stone for rings, seals and other ornaments.

Ammono'nia. [Gk. *Ammon*, a name of Jupiter.] A chemical compound of hydrogen and nitrogen, containing three atoms of the former to one of the latter. It is an alkaline substance; but as it differs from the other alkalies (see *Alkali*) in being gaseous, it is often called the *volatile alkali*. The gas is colorless, and has a very strong and pungent smell, by which it is easily recognized. It is found in minute quantities in the air, being evolved during the putrefaction of animal and vegetable substances. Traces of it are also found in rain-water and in the breath. Water absorbs it readily, hence ammonia is said to be very soluble in water. The solution is known to chemists as *liquor ammoniæ*, and in shops it is sometimes sold under the name of *hartshorn*. *Liquor ammoniæ* is sometimes used in medicine; it has a stimulating action on the breathing, and is useful in alleviating spasms,

and to some extent in counteracting the effects arising from the bites of snakes and poisonous insects. By the evaporation of liquid ammonia great cold is produced, and this fact is utilized in the manufacture of ice in ice-machines.

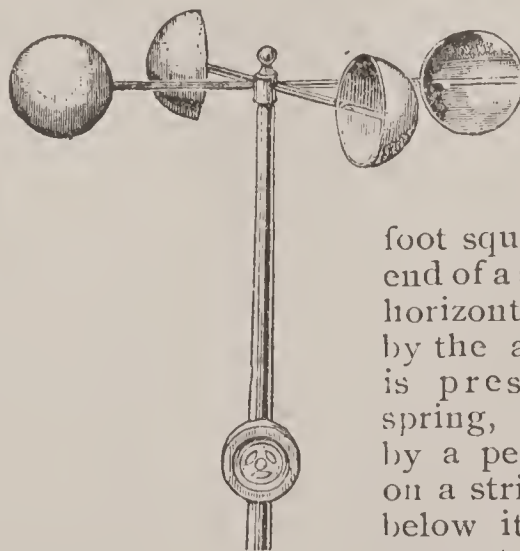
Am'ulet. [L. *amuletum*.] An ornament or any object which is worn as a safeguard against enchantment, disease, or ill fortune. It is generally inscribed with mystical characters. Amulets were greatly used in the past, and are still in use among undeveloped peoples.

Anat'omy, Comparative. [Gk. *anatome*, dissection.] The study of the structure of animals, and comparison of their various organs with one another and with those of man. It is by this study that animals are separated into families, genera, species, and other divisions. Human anatomy is confined to the study of the bony skeleton, muscles, nerves, and other organs of man.

Anæsthetic. [Gk. *an*, in-; *aisthesis*, sensibility.] A chemical substance capable of producing insensibility, much used to prevent pain in surgical operations. Nitrous oxide was first used in tooth drawing in 1844. Ether was used for the same purpose in 1846, and chloroform and other substances later. Now no important surgical operation is performed without an anæsthetic. Local anæsthesia can be produced by cocaine, by freezing the surface with a spray of ether or chloride of ethyl, and in other ways.

Ancho'vy. [Span. *anchova*.] A small fish of the Herring family, but not more than three inches long, caught in vast numbers in the Mediterranean, and pickled for exportation. The fishermen go out during the night, carrying torches in their boats. The fish see the light, and swim up to the boats in great numbers, when they are scooped up with nets.

Anemom'eter. [Gk. *anemos*, wind; and *metron*, a measure.] A wind-measurer, to show both the pressure and the velocity of the wind. A pressure anemometer measures the force of the wind on a plate one



foot square attached to one end of a spiral spring placed horizontally. The plate, by the action of the wind, is pressed against the spring, which yields, and by a pencil traces a curve on a strip of paper placed below it. Another pencil connected with the vane

records the changes in the direction of the wind. The velocity of the wind is indicated by the revolution of wheels, the number of whose turns is recorded automatically.

Anem'one. [Gk. *anemos*, the wind.] So named because the flower was thought to open only when the wind blows. A genus of plants belonging to the Buttercup family. There are several

species, one of which has a flower, white internally, more or less purple externally. Sea Anemone is the name given to certain ocean animals, of the Polyp family, which bear some resemblance to flowers.

An'eroid. (See *Barometer*.) [Gk. *a*, not; *neros*, wet; and *eidos*, form.] A barometer whose



action depends on the varying pressure of the atmosphere upon the elastic top of a metallic box from which the air has been exhausted. By a system of levers connected with the box, and an internal spring, motion is given to an index, which registers the variation of atmospheric pressure.

An'iline. [Ar. *annil*, for *alnil*, the indigo plant.]

Aniline was first prepared from indigo in 1826, and takes its name from *anil*, the Portuguese word for indigo. It is now derived from the distillation of coal-tar. It is a colorless liquid, possessing a peculiar smell, and slightly heavier than water, and boils at a temperature of 360°F. The aniline of commerce was first obtained in 1858 by a Mr. Perkin, in the preparation of a dye-stuff derived from aniline. This was known as mauve or Perkin's blue. Every shade and tint of color are produced by the aniline dyes, which are used not only in dyeing, but in preparing colored inks, in manufacturing colored papers, in printing wall-paper, and in coloring soaps, perfumes and cosmetics.

An'imal. [L. *animal*, a living being; *anima*, breath.] A living being with an organized material body, and endowed with the powers of sensation and voluntary motion. All animals are classed together in one great body called the Animal Kingdom, which is separated into a number of sub-kingdoms or grand divisions, of which the highest is the vertebrata, or animals with an internal skeleton.

Ant. [Contracted from the Saxon word *emmet*.]

An insect of the family *Formicidæ*, which embraces between two and three thousand different forms, widely distributed in temperate and tropical countries. Ants usually live together in swarms, sometimes many thousands in number, and are distinguished from insects generally by their extraordinary intelligence. Among them, as among bees, there are workers, besides the males and females. The females are the largest, the males next in size, and the workers the smallest and without wings. Ants are very active and strong for their size, and among the most industrious of all animals. Their dwellings usually consist of hillocks of earth, most wonderfully constructed, and containing many little

rooms, in which they store their provisions, and nurture their young. The food of ants consists chiefly either of animal matter, or of sweet vegetable substances, such as honey, sugar, and fruit. There are many species of ants, differing considerably in their habits—as the agricultural, carpenter, foraging, honey, amazon, etc. They have many remarkable habits, fighting battles in which large armies take part, keeping and milking the aphids, or ant-cow, cultivating certain grasses with palatable seeds by the destruction of other species, and displaying other evidences of high intelligence. The insects known as termites, or white ants, are not properly ants, but belong to a different class of insects, yet resemble the ants in intelligence. They live in hot countries, and sometimes gnaw out all the inside of the beams of houses, leaving only a thin casing. In Africa white ants live together in vast colonies, some living in houses which they dig underground, some burrowing in wood, while others build up large mounds, ten or twelve feet high, with smaller mounds around them.

An'telope. [Gk. *anthein*, to flower or shine; and *ops*, the eye.] A genus of ruminating animals, intermediate between the deer and the goat. Their horns are hollow and permanent, not annually renewed; those of the deer are solid, and shed every year. Their horns are also round and curved, with rings running round them, and are always black. There are many species in Africa, about fifteen in Asia, two, the chamois and the saiga, in Europe, and two, the pronghorn and the Rocky Mountain goat, in North America. In Africa, particularly in South Africa, antelopes are very abundant, some of the species congregating in immense herds. Their sizes vary from the Guavy, or Pigmy Antelope of Africa, only eight or nine inches high, to forms which are five or six feet high. Most of them yield palatable food, and they are much hunted.

Antèn'næ. [L. *antenna*, sail-yard.] Slender articulated organs on the head of insects and crustacea. There are two in the former, and usually four in the latter. They are used as organs of touch, and in insects are called *horns* or *feelers*.

An'thrax. [Gk. *coal*.] This was the name formerly given to the painful swelling or eruption now called carbuncle. It is now used for a disease often fatal to sheep and cattle, and occasionally attacking man. It is also destructive to horses and camels and many of the smaller animals. When acute, the animal falls and goes into convulsions, and soon dies. The disease has been known by many names. In man it is called Malignant Pustule, Wool-sorters' Disease, etc. It is believed to be due to a minute germ, named *bacillus anthracis*, which enters the system and multiplies in the blood with great rapidity.

An'thracite. [Gk. *anthrax*, coal.] A species of hard mineral coal or carbon, of a metallic lustre, containing little or no bitumen. It is difficult to ignite, but burns with intense heat, and nearly without smell, smoke, or flame. It is principally found in Eastern Pennsylvania, and is said also to be abundant in China.

Anthropol'ogy. [Gk. *anthropos*, man ; *logos*, a discourse.] The science of man. It includes the study of man as an animal and as a thinking being, and ethnology, or the study of race divisions. It includes, in short, all that can be learned about man in any direction.

An'timony. [L. *antimonium*.] A metal of a bright bluish-white color and crystalline structure. When strongly heated it burns with a white flame, giving off the fumes of "flowers of antimony," a compound with oxygen. It is a bad conductor of heat and electricity. It does not rust or tarnish when exposed to the air at ordinary temperatures. This property, combined with its hardness, renders it of great service in the arts in the formation of alloys. Pewter, type metal, Britannia metal, are all alloys of antimony. The metal is generally prepared from the mineral stibnite, a compound of antimony and sulphur. This ore is found in France, Spain, Italy, Canada, Borneo, and Australia. It has been long used in Eastern countries for darkening the eyebrows. *Tartar-emetic* contains antimony, tartaric acid and potash.

Antisep'tics. [Gk. *anti*, against, *septikos*, putrefying.] Substances which act to prevent decay or putrefaction of organic materials. Among the many antiseptics may be named sugar, alcohol, carbolic acid, charcoal, nitre, alum, and chloride of zinc. They are used for the preservation of food substances. Cold has a powerful antiseptic action, and cold storage is



ANVIL AND HAMMER

one of the best and cheapest of food preservers. Antiseptic surgery or Listerism is a mode of treating surgical wounds, introduced by Sir Joseph Lister. In this the wound and the instruments are treated with carbolic acid or other antiseptics to prevent dangerous germs from entering. This has proved wonderfully successful, and has enabled surgeons to perform operations successfully which would have led to certain death under the old system of treatment.

Anvil. [AS. *on* ; and *syllan*, to strike.] An iron block, usually with a steel face and a pointed end, upon which metals are hammered and shaped. Anvils are of various sizes, from the small steel ones used by goldsmiths to the immense cast-iron ones used under steam-hammers.

Ape. [AS. *apa*.] A term generally applied to the monkeys, though by some the Anthropoids, or highest forms, are not included in the apes. Others consider these the only apes. They usually dwell in trees, where their power of grasping with both hands and hand-like feet enables them to grasp the limbs with great ease, and to jump from branch to branch without danger of falling. They closely approach the human species in anatomical structure, and the higher forms, the gorilla, chimpanzee, and orang-outang, are often called anthropoids, or man-like apes.

A'phis. The plant louse ; a kind of insect which is parasitic upon plants, injuring them by sucking their juices. They are extremely prolific and very injurious. They exude a sweet, viscid fluid known as honeydew of which ants and bees are very fond, and ants often take care of and seem to milk the aphides. These are therefore known as ant cows.

Appendici'tis. [L. *appendix*.] This is a name given of late years to inflammation of the vermiform appendix, a small, finger-shaped tube, depending from the large intestine. Many deaths in the past whose cause was unknown, may have been due to it. If severe, it is now often healed surgically, the abdomen being opened and the inflamed appendix removed, or otherwise treated.

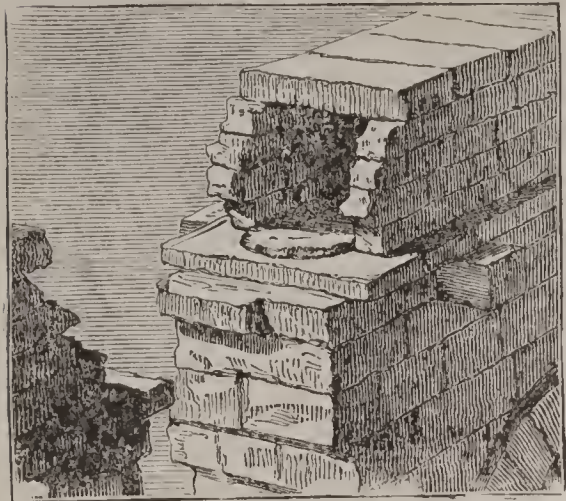
Ap'ple, [AS.] One of the most widely diffused of fruit-trees, growing best in the colder parts of the temperate zone ; also its fruit. The tree attains a moderate height, with spreading branches bearing beautiful flowers that have a delicate fragrance. The fruit is roundish in shape, with a depression at each end. The original of the cultivated apple is the wild apple or crab-tree, found in most of the countries of Europe. Though there were no apples in America when it was first settled, trees were introduced, and some of the finest apples, such as greenings, baldwins, Newtown pippins, etc., are now grown, and sent in large quantities to Europe, China and India. The number of varieties of the apple produced by cultivation is very large, and it is perhaps the most useful to man of all the fruits. The wood of the apple-tree is hard, close-grained, and often richly colored, and is used by turners and cabinet makers.

A'pricot. [Fr. *abricot*, from L. *præcox*, early ripe.] A stone fruit, belonging to the same genus as the plum, but resembling a peach, being of an orange color, oval shape and delicious taste. The tree grows wild in Armenia and the countries eastward to China and Japan, and by cultivation it has been introduced throughout the temperate zone. It was brought into Europe in the time of Alexander the Great, and into England about the middle of the 16th century. The dried apricots of Italy are sent to foreign countries, those of Bokhara and

other parts of the East to Russia, while the preserved apricots of Damascus are famous. Many apricots are now raised in California.

Aqua'rium. [L. *aqua*, water.] An artificial pond, or a globe or tank (usually with glass sides), for containing and showing aquatic animals and plants and their modes of living. Small aquariums are now often kept in houses for study and amusement.

A'queduct. [L. *Aqua*, water, and *ductus*, passage.] An artificial channel to convey water for



city supply and other purposes. The Romans had great stone aqueducts, in some places raised on high arches, in others cut through the hills. Some of these are still in use. Some of the

largest of modern aqueducts are the Croton Aqueduct, which conveys water to New York City, and the Cochituate Aqueduct, of Boston, which is fifteen miles long.

Arch. [L. *arcus*. Fr. *arche*.] A self-sustaining structure, usually of a curved form, made up of separate wedge-shaped solids, with the joints between them disposed in the direction of the radii of the curve, used to support the wall or other weight above an opening. The beginning of the arch is called the spring, the two bottom stones being the springers, the middle the crown or keystone, and the parts between the crown and the spring the haunches. A flat arch is constructed of stones cut into wedges or other shapes, so as to support each other without rising into a curve.

Archæol'ogy. [Gk. *archaios*, ancient.] The study of the ancient relics of human art. These are very numerous, and are found in all parts of the earth, advancing from the rough tools and weapons of the stone-age to the splendid examples of the five arts found in the mines of ancient Greece.

Ar'chery. [L. *arcus*, bow.] The art of shooting with a bow and arrow. This was in very common use before the invention of firearms, and archery is still practiced as an amusement. The bow is usually made of yew or ash, and the arrows of ash. A good archer can send an arrow from 200 to 250 yards. In the Middle Ages the fate of battles was often decided by the skill of the archers.

Ar'gon. A gas existing in the atmosphere, first discovered in 1895 by Lord Ragleigh and William Ramsay. It is heavier than nitrogen and occurs in a very minute quantity. The discoverers were rewarded by the Smithsonian Institution with a prize of \$10,000, offered for the most important new fact concerning the atmosphere.

Armor. A protection worn in ancient time consisting of helmet, body armor, and limb armor, though varying at different periods in the amount of the body covered. The shield served

as a moveable piece of armor. Since the invention of gunpowder armor has been of little use and hence has been discarded.

Armor-plate. The larger and more powerful warships are in these times covered with a strong armor made of thick plates of steel, in some cases from 16 to more than



20 inches thick. The steel is often alloyed with nickel to make it harder, and its surface is specially hardened, so as to enable it to resist the blows of the great shot from modern rifled cannon. The armor-plate is carried below the water-line, and covers the gun turrets, while thinner plate is laid on the decks. Not only battle ships, but forts, are now made strong by armor-plate, which shields the men, and behind which the guns are drawn down after firing.

Ar'rowroot. A kind of starch used as food, obtained principally from the root of a West India plant now cultivated in many warm countries, and from some other plants. It is said that the Indians used the root to cure the wounds made by poisoned arrows, hence the name.

Ar'senic. [Gk. *arsen*, a male (on account of its strength).] A metallic element, seldom found free in nature, but frequently found in combination with other elements, such as sulphur, iron, cobalt, and nickel. The metal is generally prepared from arsenious oxide, or *white arsenic*, one of its compounds with oxygen. It has a bright-gray lustre; it tarnishes in the air by oxidation; its weight is about five and a half times greater than water; when heated to dull redness it rises into vapor without first fusing, and its vapor emits a strong odor of garlic. Metallic arsenic is not of great importance in the arts. An alloy of copper and arsenic produces a brilliant gray metal used in the manufacture of buttons. A compound of arsenic and copper forms a bright substance largely used as a pigment under the name of *Scheele's green*. It was formerly much employed by paper-stainers in the manufacture of wall paper. Sheep-dipping

mixtures consist of a compound of arsenic and soda dissolved in a large quantity of water, together with soap and sulphur. Arsenic has long been used as a medicine, and is used in some countries with the belief that it improves the complexion, but it is a dangerous poison, being fatal to adults in doses of from 2 to 3 grains. No effective antidote to it is known.

Art. An art is something performed by man through the instigation of the mind. In use the word is divided into the Common and the Fine Arts. A common art is something done for the benefit of man, such as the arts of manufacture. A fine art is something done for the enjoyment of man, as the art of painting.

Ar'tery. [Gk. *arteria*, the windpipe; a blood-vessel.] One of the vessels or tubes which carry arterial blood from the heart throughout the body, and venous blood from the heart to the lungs. They have thicker and more muscular walls than veins, and are connected with them by capillaries. In man and other mammals the arteries which contain arterialized blood receive it from the left ventricle of the heart through the aorta. The pulmonary artery conveys the venous blood from the right ventricle to the lungs, whence the arterialized blood is returned through the pulmonary veins.

Ar'tesian Wells. In nature it often happens that a layer of water collects between two strata, such as clay, through which water cannot penetrate. If the ground from which the water has been gathered is high, the pressure at the bottom of the layer will sometimes be very great; and on boring through the retaining bed, the pressure of the water will be sufficient to force it up the shaft to the surface of the ground, and in some cases to cause it to spring into the air from the mouth of the well. This is in accordance with the hydrostatic law that water rises to its own level. In Europe, this method of boring was first practiced in the ancient French province of Artois (hence the name Artesian); but it is now extensively applied in all parts of Europe, in America, and in other parts of the world. The artesian well at Grenelle, near Paris, is 1,798 feet deep; another at Passy, near Paris, is 1,923 feet deep. In America the borings reach a depth of from 2,000 to 3,000 feet. The water from these deep wells being always warmer than surface water, maintains a constant temperature in hospitals and manufactories, warms greenhouses, and reduces variations of cold in fish-ponds.

Ar'tichoke. [Ital.] A plant like the thistle, but having large, scaly heads like the cone of the pine tree. It is cultivated in the south of Europe, and is much esteemed as an article of food. The unripe flower-heads are boiled, and the fleshy lower part of the scales or leaves eaten, dipped in olive oil or butter, with a little salt and pepper.

Artillery. [Fr., from Low L., *artillare*, to make machines.] Weapons of war; large ordnance, including guns, howitzers, mortars, rockets, and engines of war of all kinds, with their carriages, ammunition, and apparatus. Also the men and

officers of that branch of the army to which the care and management of artillery are confided.

Asbes'tos. [Gk. *asbestos*, that cannot be quenched.] A mineral substance, unaffected by fire, occurring in long and delicate fibres, or in fibrous masses or seams, usually of a white, gray, or green-gray color. The finer varieties have



been wrought into gloves and cloth which are incombustible. The cloth has been recommended for firemen's clothes. Asbestos is also employed in the manufacture of iron

safes, fireproof roofing, and lamp-wicks, and is used, as a poor conductor of heat, for packing around steam pipes, valves, etc. The largest mines are in the province of Quebec, Canada.

Ash. [AS.] A genus of trees of the Olive family, mostly natives of Europe and of North America. There are about fifty species. The common ash is a beautiful and umbrageous tree, highly ornamental in parks, growing generally with a smooth stem to a height of from 100 to 150 feet, its wood being white, tough, and hard, in value next to that of the oak, and much used by wheelwrights, coachmakers, joiners, and turners. Among other varieties, the weeping ash, the curl-leaved ash, and the entire-leaved ash may be mentioned. The most important ones in the United States are the white ash, the black ash, the red ash, the blue ash, and the swamp ash. The white ash has the best wood, and is used for the same purposes as that of the common ash. The manna of commerce is a sugar from the sap of the manna ash, a kind of ash tree growing in Southern Europe, especially in Sicily, whence the finest manna is obtained.

Asp. [Fr., from Gk. *aspis*, an asp.] A small, hooded, poisonous serpent of Egypt and Libya, whose bite is often fatal.

Aspar'agus. [Gk. *asparagos*.] A plant grown in gardens for the sake of its young and tender shoots, which form a valuable and well-known article of food. The plants have erect, many-branched stems, and very slender branchlets, which are sometimes mistaken for leaves.

As pen. [AS. Bot. name *Papulus tremula*.] A species of poplar tree growing in Europe and in Siberia. It has received the specific name *tremula*, from the trembling of its leaves, which move with the slightest impulse of the air. The wood is white, soft, light, and smooth. It is not good for fuel, but is much in use for the turning-lathe, in making troughs, trays, and pails. The bark contains a bitter, alkaloid called salicin, and charcoal made from the aspen tree can be used in the manufacture of gunpowder.

As'phalt or Asphalt'um. [Gk. *asphaltos*, bitumen.] A kind of mineral pitch or compact native bitumen, found on the surface and shores

of the Dead Sea, which is therefore called Asphaltites, or the Asphaltic Lake. It is found also in Asia, Europe, and America, there being a very extensive lake-like deposit of it in the island of Trinidad, West Indies. It is brittle, and of a black or brown color; melts and burns when heated, leaving no residue.—*Asphaltic cement* is a composition of bitumen, pitch, lime, and gravel, used for forming pavements, and as a waterproof cement for bridges, roofs, etc. It has been of late years very largely used as a paving material in the United States and Europe.—*Artificial asphalt* is prepared from coal-tar, lime, and sand.

Ass. [L. *asinus*.] An animal closely allied to the horse, inhabiting the mountainous deserts of Tartary and other parts of Asia. It is smaller than the horse, and has long ears, an upright mane, a tufted tail, a streak along the back and across the shoulders, and gives a peculiarly harsh bray. The tame or domestic ass is remarkably hardy, patient, slow, and sure-footed, and has become the type of obstinacy and stupidity. The skin is hard and elastic, and is used for covering drums, making pocket-books, parchment, etc. It is of asses' skin that the Orientals make a kind of grained leather called shagreen.

As'teroid. [Gk. *aster*, a star, and *eidos*, form.] The asteroids are a group of very small planets between the planets Jupiter and Mars. Ceres, the first known of these, was discovered on January 1, 1801, the first day of the nineteenth century. Before the last day about 450 had been discovered. Nearly all of these are very small. Ceres is about 1200 miles in diameter, but many of them are only a few miles through. They may be fragments of a former planet, for they occupy the place in the solar system where, by the calculations of the astronomers, a planet should be.

Astrol'ogy. [Gk. *aster*, a star, and *logos*, a discourse.] The name of a system based on the science of astronomy, in which it is claimed that future events, and the coming fortune of any man, can be told from a study of the planets. The early astronomers were all astrologers, and watched the stars in order to predict the future from their movements. Astrology was widely believed only a few centuries ago, but now none but the ignorant have any faith in it, and it is professed only by rogues or fools.

Astron'omy. [Gk. *astron*, a star; and *nomos*, a law.] In its widest sense, it includes everything that is known concerning the heavenly bodies. It treats of their motions, relative positions, distances, magnitudes, mutual influence, constitution, and physical condition. The history of astronomy dates back to very remote ages. The Chinese, Hindus, Babylonians, and Egyptians each possessed some knowledge of the science, and had made some progress in astronomical observation many centuries before the commencement of the Christian era. It was first raised to the dignity of a science among the Greeks. The most eminent among ancient astronomers was

Hipparchus, who discovered the precession of the equinoxes and other facts of importance. Ptolemy, the next astronomer of note, founded the system which makes the earth the centre of the universe, around which the mighty circle of the heavens revolves once in twenty-four hours. Copernicus (1473–1543) showed the error of this theory, and made the sun the centre of the solar system, the earth and the other planets revolving around it. The science has been much advanced by Tycho Brahe, Kepler, Galileo, Newton, Herschell, and many others of note, while the instruments of observation have increased in power until the universe has been explored to remote depths and hundreds of facts concerning its constitution discovered. Most marvelous among these are the vast number and immense distances asunder of the stars, and the wonderful discovery, which we owe to spectrum analysis, that our sun, and the fixed stars, which are the suns of other solar systems, are largely or wholly made up of the chemical elements found in the earth—such as hydrogen, iron, and others.

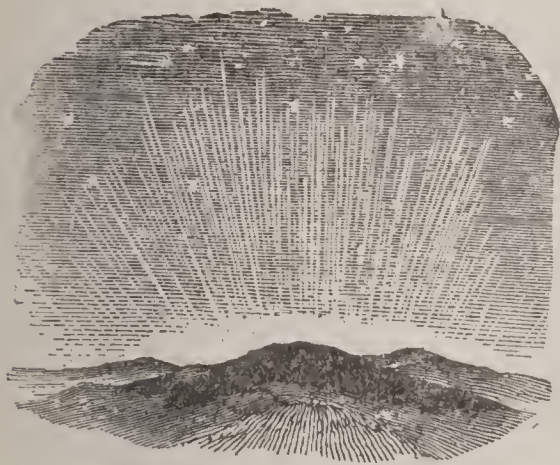
At'mosphere. [Gk. *atmos*, vapor; and *sphaira*, sphere.] The name of the great body of gaseous substance which surrounds the earth. The atmosphere consists essentially of two gases, oxygen and nitrogen, with a small quantity of carbonic acid and some aqueous vapor, with minute proportions of a few other substances. The vapor of water is of much importance in relation to the weather of any locality. The atmosphere being gaseous, obeys the same laws as gases under varying conditions of pressure and temperature. There is reason to believe that its extreme height may be not less than 500 miles, this result having been found by observations on the flight of meteorites. Air being a fluid, exerts pressure equally in all directions. This pressure, or the weight of the atmosphere, at sea-level, is equal to 15 pounds on every square inch of surface. It has been found that the average height of a column of mercury which will balance the pressure of the atmosphere is about 30 inches. (See *Barometer*.)

At'om. [L. *atomus*.] The smallest particle into which matter is considered to be divided. Atoms are inconceivably small, and are supposed to combine into molecules—containing two or more—which form the smallest chemical particles. The atom of each chemical element has a fixed weight, and tables of their weights, as compared with the hydrogen atom, are commonly given.

Au'ger. [AS.] A tool for boring holes, larger than those made by a gimlet. It has a handle placed crosswise, by which it is turned with both hands. The *pod-auger* and the *screw-auger* are the two principal kinds. The former has a straight channel or groove, while the latter has a twisted blade, by the spiral groove of which the chips are discharged.

Auro'ra Borea'lis, [L.] or **Northern Lights.** Luminous appearances which are seen in the northern quarter of the heavens. A muddy appearance of the sky in the direction of the north is the first indication of the approach of the aurora. This gradually resolves itself into a

band of a dusky hue, in shape like part of a circle, stretching from the north towards the west, with its ends resting on the horizon, and surrounded by a continuous luminous arch of transparent white tinged with green. The arch is in a state of continual movement, either rising and falling or swaying from east to west, and starting from it, streams of light of brilliant and



variegated colors shoot up towards the zenith. The most reliable measurements place the height of the aurora at from 45 to 100 miles above the earth. It is now regarded as certain that there is an intimate connection between the aurora

and the magnetism of the earth, this being shown by the fluctuation of the magnetic needle during an auroral display, and also by the fact that the top of the luminous arch is found to be near the magnetic meridian. The aurora has been frequently observed to occur at both magnetic poles of the earth simultaneously. Auroræ are more frequent in North America

than in the same latitudes in Europe. Thunderstorms and auroræ are connected with each other—the former being characteristic of the tropics, and the latter of the polar regions. In Norway, Siberia, and Lapland auroras enliven to some extent the snowy landscapes and brighten the long winter evenings, and they furnish much light during the protracted nights at the Arctic region.

Aut'omobile. [Gk. *autos*, self; L. *mobilis*, movable.] A self-moving carriage, distinguished at first as a horseless carriage. Steam and gasoline engines and electric storage batteries are used as propelling powers, and automobiles came rapidly into use near the end of the nineteenth century. A great development of them seems probable in the twentieth century.

Av'alanche. [Fr. from L. *ad vallem*, to the valley.] A vast body of snow, ice, earth, rocks, etc., sliding swiftly down a mountain side or falling down a precipice.

Axe. [AS.] An instrument of steel or iron, with a steel edge or blade, for felling trees, hewing timber, chopping and splitting wood, etc. The handle of an axe is called the helve, the thick metal part the head, and the hole for the handle the eye, and the handle is so fixed in the eye as to be in the same plane with the blade. The carpenter's axe for hewing timber is heavier than the chopping axe, and has a broader and thinner blade and a shorter handle.

B

Baboon'. [Fr. *babouin*, and *babines*, large lips.] A kind of monkey with a short tail, very fierce and dangerous, and not so often tamed as others



of the Monkey tribe. It is found in the hottest parts of Africa and in Siam. Its long snout or lips give its head somewhat the shape of a dog's

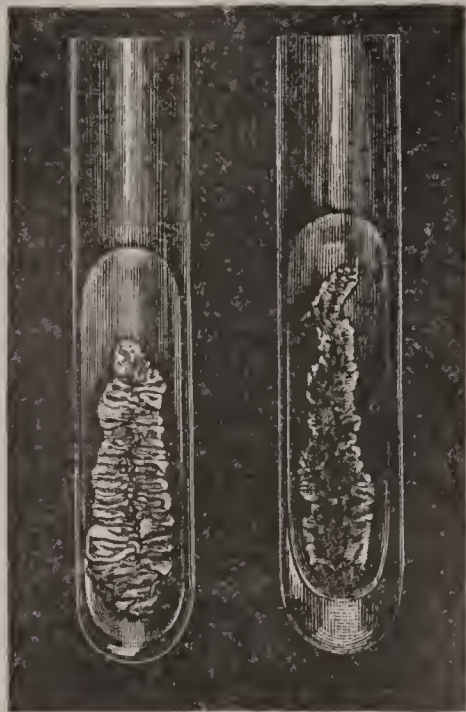
head. It lives chiefly on fruits, corn, and roots, and has large cheek pouches in which its food is kept until needed. The baboons are quadrupeds living on the ground, and running swiftly on all fours, while many of them live in herds, and are formidable to animals and property. The troops are led by patriarchs and guarded by sentinels, and fight fiercely when attacked. There are many kinds of baboon, but the best known are the pig-tailed, the dog-faced, and the mandrill. The nose and cheeks of the mandrill are ornamented with red and blue stripes, and its appearance is made remarkable by other patches of gaudy color.

Backgam'mon. [AS. or Dan.] A game of chance and skill played by two persons on a board with dice and fifteen pieces or "men" each. The board is divided into tables, each table being marked with six points colored alternately white and black. The moves of men are determined by throws of the dice; and if a point is occupied partially or fully by the opponent, the man is set back.

Ba'con. [Fr.] The back and sides of a pig salted. The hair is singed instead of being scalded, and the meat is separated from the shoulder-blade and bones, and cured by salting and drying.

Bacte'ria. [Gk. *baktron*, a rod or stick.] The name of a family of extremely minute plants, consisting of a single cell, and only visible under a high power of the microscope. They are found almost everywhere, and all fermentation and

putrefaction are due to them. While the most of them are harmless, and very useful in removing decaying substances, others are highly dangerous to life, forming the "germs" or "microbes" of contagious diseases. This fact was first discovered by Louis Pasteur, and gave rise to the science of Bacteriology. The harmful bacteria enter the body of animals, multiply with extreme rapidity, and give off poisonous products or toxins which cause violent and often deadly diseases. Among these are yellow fever, cholera, small-pox, diphtheria, malarial and typhoid fevers, and various others, also anthrax and other diseases of the lower animals. In the treatment, the use of anti-toxins, prepared by inoculating animals with weakened bacteria, has proved of much service, but the science of bacteriology is so recent that much remains to be learned.



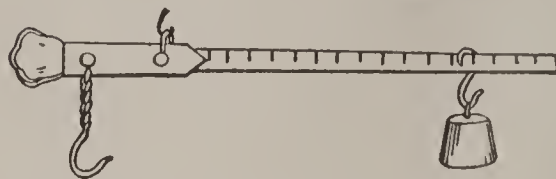
DISEASE GERMS

Badg'er. [Probably from *badge* and *ard*, in reference to the white spot on its forehead.] A carnivorous quadruped of the Weasel family. It has a broad, flat body, short tail, and long tapering head. It is a quiet, harmless animal; but when attacked by dogs, turns on its back and defends itself with its teeth and claws. It burrows in the ground with its nose and fore paws, and forms a nest lined with grass and moss, from which it goes forth at night in search of food, which consists of roots, fruits, and small animals. It is found in Asia, Europe, and North America.

Bag'pipe. A musical instrument made of a leather bag, filled with wind by a tube blown by the player. There are other three or four tubes, one a chanter with eight holes. G-clef is the only scale used. It is an ancient instrument, and was known to the Greeks and Romans. It is the national musical instrument of the Scottish Highlanders, and is used in the Tyrol and in other parts of Europe.

Baking-Powders. Chemical substances used instead of yeast in bread-making, their action being to give off carbonic acid gas, which puffs up the dough, or causes the effect called "rising." They are usually composed of tartaric acid and bicarbonate of soda. A chemical action takes place in these in contact with the wet dough, and the gas is given off. Other substances are used, alum being common, though it is thought to be injurious; also acid phosphate of calcium. The use of baking-powders has grown enormously in recent years, and yeast is little used.

Bal'ance. [L. *bis*, double; and *lanx*, a dish.] A machine used for weighing. The common balance consists of a beam supported at its middle point, having two scale-pans of equal weight hung from its extremities. The object aimed at in its construction is to secure delicacy and rapidity in weighing. Of other forms of lever, the Roman balance, or *steelyard*, consists of a rod suspended from a fulcrum, so that the two arms are of unequal length. The substance to be weighed is suspended from the shorter arm, and a movable mass is made to slide along the longer arm,



which is graduated to indicate quantities. This form of balance is in use at railway stations for weighing luggage and loaded carts. The spring balance shows the weight of a body by the extent to which it stretches a spiral spring.

Balloon'. [Fr. *ballon*.] A large bag made of silk, and filled with light gas, coal gas being now generally used. It rises in the atmosphere, because its weight is less than the weight of air which it displaces. A car, supported by a network attached to the balloon, carries the aeronauts; when they wish to ascend more quickly, they throw out some of the ballast, which consists of bags of sand; when they wish to descend, they open a valve at the top, which allows some of the gas to escape. Ascents have been made to determine the pressure and temperature of the air at different heights. In some cases balloons have risen to a height of five miles, and in one instance to seven miles. Balloons have been used as aids in war, and are now being applied in flying machines.

Bal'sam [Arab.] or **Balm** [Gk.] A liquid aromatic substance, of resinous character, which under the name of Balm of Gilead has long been famous in the East for its fragrance and medicinal virtues. It is the product of a shrub growing in Arabia and Egypt. The word balsam, when used alone, now signifies the balsams of Peru and Tolu, a viscid and very fragrant liquid, obtained from two species of South American trees. They are used to flavor confectionery, also in perfumery, and as stimulants and tonics in medicine. Balsam of Canada is the liquid resin of *Abies balsamea*, a species of fir. There is also a genus of trees in the East Indies and Japan known as balsam, of which some species are of great beauty and are widely grown elsewhere. (See *Gums, Resins*.)

Bamboo'. [Malay.] This is the giant of grasses. It is a most useful and graceful plant. Its stem is hollow, and at intervals it forms joints or knots; and its flower is enclosed in scales, as in the common grass. It grows everywhere in the tropics—in China, India, and the valleys of the Andes. There are many kinds—the most common being from 40 to 80 feet long, and of any thickness up to 20 inches. Many stems rise from the same root or from the higher joints.

Young shoots contain a sweet pith, and are eaten as asparagus. With the stem the Malay builds his house, and furnishes it with chairs, tables, beds and bedding of the same material. It is made into sails, cables, hats, paper, fishing-rods, pipes, bridges, flutes, handles of tools and weapons, buckets and bottles.

Bana'na. [Span.] The fruit of a tree of the same name, belonging to the same family as the plantain. Its leaves are about 6 feet long, and its fruit grows in great bunches and is a most important food in hot countries. Its fibre is used for shoe-strings and for ropes of all kinds. The banana was probably first grown in the East Indies, but is now much cultivated in the West Indies and in tropical America. Its produce is enormous, being estimated on an acre as 133 to 1 of wheat. A plant of the same genus, in the Phillipine Islands, yields the well-known and very useful fibre named Manila hemp.

Bandan'a. [Hind.] A red or colored silk or calico handkerchief with patterns or white spots. The handkerchiefs are pressed between hydraulic plates with holes or patterns, and the bleaching fluid poured into these holes passes through and produces the spots or patterns.

Ban'yan. [Bot. name, *Ficus Indica*.] The sacred tree of India, and one of the wonders of the vegetable world. It is of the Fig family, and is called the Indian fig. Its seeds carried by the wind or dropped by birds are often deposited in the crowns of palms, and send down roots which become stems, in time taking the place of the palm. These grow to trunks from 60 to 100 feet in height, from whose branches in time, pendulous adventitious roots descend to the ground and in their turn become stems. This process continues until a single tree spreads over acres of ground and becomes a wood in itself. At Nerbudda, India, there is a tree with 354 large trunks and 3,000 small ones, which is inhabited by great numbers of birds, fruit-bats and monkeys, the latter eating the leaves as well as the fruit. The Brahmins of India hold the tree in great reverence, and build their temples in its vicinity.

Ba'obab. A tree of tropical Africa; known also as the monkey-bread tree. Its size is gigantic, and it lives to a great age. Its trunk does not usually exceed 40 feet in height, but its girth sometimes reaches 75 feet. Its branches are from 50 to 75 feet long, and touch the ground. The fruit is abundant, and of the size of a citron, its pulp being pleasant and slightly acid. The juice sweetened with sugar, makes a cooling and refreshing beverage. The bark yields a very strong fibre.

Bar'berry. [*L. berberis*.] A shrub which grows wild in northern Europe and Asia and in parts of the United States. In Italy it grows to the height of a plum tree, and is very ornamental when covered with its bright red berries. These are very sour, but make a pleasant drink, and good preserves and jelly. A fine yellow dye for leather is made from the bark and roots.

Ba'rium. [Gk. *barys*, heavy.] One of the metallic elements, first isolated by Sir H. Davy, from whom it received its name. It occurs in *heavy spar* (sulphate of barium) and in baryta (a compound with oxygen). Some of its compounds are used in the preparation of fire-works.

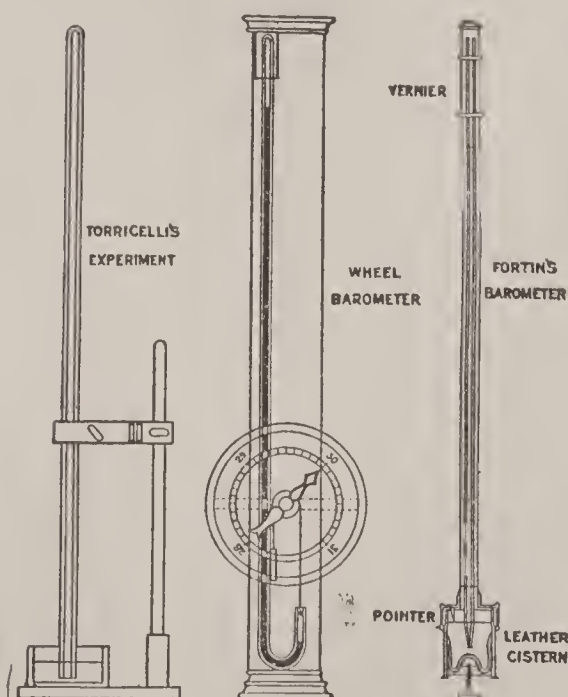
Bark. [Dan.] The exterior covering of the trunk and branches of exogenous trees, the endogens and the ferns having no true bark. Some barks are very thin and others thick; those of the giant trees of California are two feet thick. The outer bark protects an inner bark. In many trees the outer bark is coarse, and has no life in it. The inner bark is fresh and full of sap. The sap which goes up through the wood of the tree from the roots to the branches comes down through the inner bark. Bark is useful for dyeing and tanning leather, and certain kinds are made into corks. Quinine is made from Peruvian bark. (See *Cinnamon*, *Cork*, *Exogen*.)

Bar'ley. [AS.] A plant of the Grass family, cultivated for its seeds, which are a valuable grain used for food. It is hardier than wheat, maize, or oats, and is grown in northern countries like Russia, Norway, Denmark, Scotland, etc., being found as far north as latitude 70°. Barley is a shallow-rooted plant, drawing its plant-food mainly from the surface layer by curious root-hairs. Barley-meal is used for fattening pigs and cattle, and when boiled, horses also. Barley is mostly used in brewing beer and ale, and in distilling spirits.

Bar'nacle. A genus of ocean animals, called also acorn shells. These belong to the order of the crustaceæ, swim when young, but afterwards attach themselves to rocks, ships, sea plants, etc., develop a shell, and become fixed for life. They gather thickly on the bottoms of vessels in the tropics and much impede their speed.

Barom'eter. [Gk. *baros*, weight; and *metron*, measure.] An instrument for measuring the pressure of the atmosphere. Barometers are di-

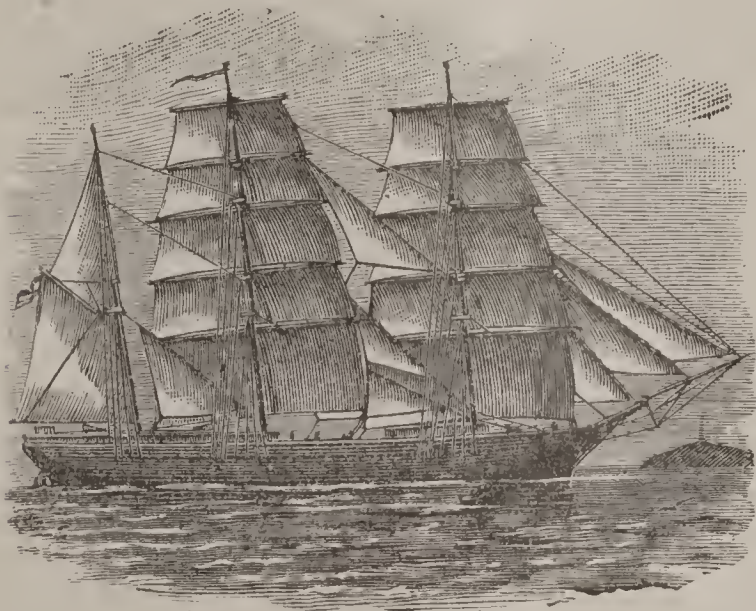
vided into two classes, *cistern* and *siphon*; and in each of these classes there are several forms. The simplest form of the cistern barometer consists of the Torricellian tube, with the addition of a graduated scale to show the height of the mercury column. In ordinary weather-glasses, the tube is bent round at the bottom, and the cistern is an expansion of the tube. At the upper end of the tube is a fixed scale of inches, and



round at the bottom, and the cistern is an expansion of the tube. At the upper end of the tube is a fixed scale of inches, and

tenths of inches, beginning with 27 and ending at 31 inches. A vernier slides along the fixed scale for measuring fractional divisions. In the *siphon* barometer the tube, which is generally of uniform bore, is bent into the form of a siphon, the longer leg of which is closed and the shorter opened. Of the various forms of this class, that known as the *wheel* barometer is the most common for household use. In this the rise and fall of the mercury turns a small wheel, which moves a pointer and dial. The wide sweep of the pointer makes small changes in the height of the mercury very evident. One of the important uses of the barometer is that of measuring the heights of mountains. The pressure of the air on the top of a mountain is less than that at the bottom by the weight of the column of air intervening between the top and the bottom. The difference between the readings of the barometer at the foot of the mountain and the readings on the top gives the means of calculating its height. The most important of all the uses of the barometer is its employment for meteorological observations.—*Aneroid Barometer.* (See *Aneroid*.)

Barque, or Bark. Any small ship, but especially a vessel, small or large, with three masts, the



fore and main of which are rigged as in a ship, but the mizzen is rigged fore and aft.

Bar'el. A cylindrical receptacle made of grooved staves bound together by hoops, and with heads fastened by dowels. The staves are planed, bent, and grooved by machinery. The name *barrel* includes keg, cask, pipe, hogshead, and butt. Over 1,300 millions of staves are made annually in the United States, chiefly of red and white oak and elm.

Basalt'. [*L. basaltēs.*] A rock of igneous origin, occurring chiefly in the ancient trap series of rocks. Basaltic rocks are composed of feldspar, augite, and magnetic iron, and other minerals, such as *olivine*. In color they are blue, brown, and black. They occur both as lava-flows and as sheets or dikes intruded between other strata, and are sometimes found in columns, which may be perpendicular or inclined, and of regular or irregular structure, as at the Giants' Causeway in Ireland.

Base=ball. An athletic game, which takes the place in the United States that cricket holds in England. It is played on a square area, whose corners are called bases. The ball is struck by a bat, and the batsman seeks to run from his station to one or more bases before it can be returned by the opposing players in the field. The party making the greatest number of runs round the complete square wins the game. There are nine players on each side, including the pitcher, batsman, catcher and fieldmen.

Bask'et. The weaving of wicker work is one of the oldest arts known to man. The shoots of the willow or osier are mostly used. Ash, elm, and birch shoots are also used. Baskets are made of a great variety of shapes and sizes, and basket work is used for various other purposes, such as screens, chairs and pony carriages. Boats have been made of basket-work covered by skins, and the ancient Britons used basket shields.

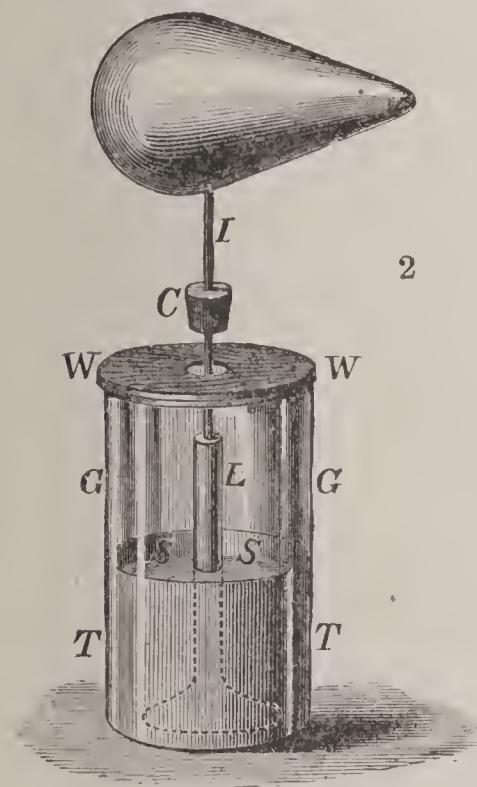
Bass. [A corruption of *barse*.] A spiny-finned kind of perch used for food. There are many kinds, including the black and rock bass and sea bass of America, the common European bass, the striped bass, the white or silver bass of the American lakes, and the brasse or yellow bass. The black bass builds on the bottom a saucer-like nest, where it deposits its eggs, and where, when hatched, the fry are carefully protected.

Bat. [O. E.] An animal with wings of a thin membrane of skin. The finger bones are very long and slender, and the membrane is stretched between them and extends from the arms to the legs. It is filled with nerves, so that blind bats can fly with as much confidence as those that have the use of their eyes. The Bat family is called *Cheiroptera*, or wing-handed animals. They feed on minute insects, and sleep during the day in old ivy-covered buildings, hollow trees or caves. When sleeping the bat suspends itself with its head downwards, and hangs by the curved claws of its hind feet. If it alights on the ground, it has difficulty in taking to the wing; but when hanging it unhooks itself, and its wings are at once free to strike the air. The collared fruit bat of India is from its size and color named the flying-fox, and feeds on fruit. Fruit bats suspend themselves by one foot when sleeping, tucking the other foot under the wing. Vampire or blood-sucking bats inhabit tropical America. They bore little holes in the skin of their sleeping victim, or shave off a piece of skin. (See *Guano*.)

Baths. [AS.] Places for washing in, either for cleansing the skin or strengthening the body. For cleansing, tepid or warm baths are most effective; but being relaxing, they should not be used too often. The cold morning bath, either plunge, or sponge, is very beneficial to healthy persons. Sea-bathing is preferable to bathing in spring water. Turkish baths and electric baths are now in favor among rheumatic patients. Roman baths embraced swimming-baths, warm baths, baths of hot air, and vapor-baths. Other baths, as Russian, mud, douche, etc., are medicinal or of the nature of luxuries.

Bat'tleship. This term refers to a heavily armored ship of war, carrying immense guns, which are placed in revolving armor turrets. One of these ships is like a floating fortress. They differ from the cruiser, which has thinner armor and lighter guns, and is built for greater speed.

Bat'tery, Ley'den. An electric battery, consisting of a number of jars joined together in such a manner that they act like a single large jar. The jars are placed side by side in a box or tray lined with tin-foil, which thus unites their outer coatings with each other and with the ground, while their inner coatings are connected by brass rods, joining together the knots of the jars. They are used to accumulate a strong charge of static electricity. The parts of a jar are: TT tin-foil; SS sulphuric acid; L leaden rod, with upper



part I of iron; W wooden cover, closed by the cork C, to keep out the dust when not in use.

Bay'onet. [Fr. *bayonnette*.] A sharp, straight, tapering steel pike or sword, capable of being fastened to the muzzle of a musket or rifle. It is named from Bayonne in France, where the first was made about 1640.

Beads. [AS.] Perforated balls of glass, porcelain, or gems worn for ornament; also a small ball for counting prayers. The glass houses of the island of Murano, near Venice, have been, from a remote period, a centre of the manufacture of glass beads. Upwards of five thousand people are there employed in this industry. Beads are much used for fancy work. "Bugles," or long beads, were formerly used, but now jet beads are common for trimming ladies' dresses.

Bea'con. A signal fire, or an erection at the entrance of a river or harbor, to give warning of dangerous navigation. Beacon fires are of great antiquity, and by their use news were quickly flashed from hill to hill across a wide area. Iron pots to hold the beacon fuel were often placed in church towers.

Beak. The point of anything; the bill of a bird. The beak is a conspicuous feature in all birds, and consists of an upper and lower half. The upper half is commonly articulated with the skull in a more or less immovable manner. The parrot possesses this feature in its greatest perfection, but it exists in a less complete form in many birds. In no recent birds are teeth ever developed, though rudiments of teeth have been recognized in some parrots, and fossil birds have

been found with well-developed teeth. The beak of each bird is beautifully adapted to its habits. Beaks of land-birds are hard and horny—in the woodpecker like ivory. In many water birds the beak is rather of a leathery texture. The beaks of birds of prey which feed on flesh are strong, hooked, and pointed, those of herons and storks, which feed on fish, are long, pointed, and sharp; the beak of the parrot, which feeds on nuts, is adapted to crushing the shell and picking out the kernel; the beak of the duck is flat and broad, with comb-like fringes on the upper jaw which fit into the lower jaw. In the puffin and similar birds part or the whole of the horny sheath is annually shed.

Bean. [AS.] The seed of various pod-bearing plants used for food. The two principal field beans are the Scotch or horse bean, and the tick bean. There are also many varieties of garden beans, such as the long pod and broad Windsor. The bean is a valuable source of food for men and the domestic animals and is grown in most of the temperate climates of the globe, being used as human food in its unripe state and as food for animals when ripe. French or kidney beans are grown for the green pods. Haricot beans, which are almost the same as French beans, are largely grown in France and Italy. The Lima bean is a variety of the pole-bean.

Bear. [AS.] A large carnivorous animal, with a rough, shaggy coat and a peculiar gait. It



walks on the sole of the foot (plantigrade.) It has five toes on each foot, and when fighting stands nearly erect on its hind feet, and strikes with the fore paws or clasps its antagonist forcibly. Though a flesh-eater the bear

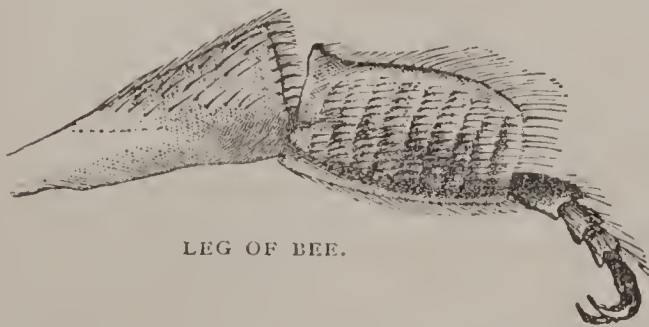
prefers vegetable food, and is fond of the fruit and roots of trees. Most bears are good climbers of trees. The bear partially hibernates, the female shutting herself up when with young, and being without food until the following spring. The brown bear of Europe and Asia is sometimes exhibited as a performing animal. There are also the black bear and grizzly bear of North America, the sloth bear of India, the Syrian bear of Scripture, and the polar or white bear, which, with its yellowish fur, lives among ice, and is a good swimmer, and preys on the seal and walrus. The ant-bear, the sea-bear, etc., are not real bears, but belong to quite different orders of animals.

Bea'ver. [AS. *L. fiber*.] An interesting rodent animal, valued for its fur. Formerly abundant in North America, it is now scarce, and found

only inhabiting the banks of rivers in wild parts. The hind feet are webbed for swimming, and it has a curious broad tail, flattened like a paddle, which is used as a rudder. It builds lodges of branches and mud about 3 feet high and 7 feet in diameter, and is very sagacious in making a dam or artificial bank of wood, stones and clay, to protect the lodges. The entrances are at all times beneath the water, so that the animal can enter or leave its home in safety. Its powerful teeth are its chief tools, and it cuts down trees of great size by gnawing a groove all round, so that they fall as it desires, and it then cuts them into lengths. The food of the beaver is the bark of trees, and it lays up a store for winter by cutting branches and sinking them under water, placing stones on them. The fur of the beaver was formerly used for hat-making, but is now used for trimming ladies' cloaks and for gloves; and the material called castor is obtained from two small bags in the groin of the animal.

Bed. [AS.] Something to rest or sleep on. Many substances have been used for this purpose, such as skins, heath and rushes, straw, etc. Feathers have long been used. The East Indians lie on the floor on light mattresses, the Japanese on matting, the Chinese on low bedsteads. In Europe, bedsteads are used with two mattresses—the upper being made of hair or down, and the lower of cotton. The best beds are made with steel springs, covered with a hair mattress. These are coming largely into use, for hygienic reasons, the feather bed not being conducive to health, while the close bed-curtain has been generally discarded. Folding beds, which by day look like a desk or other article of furniture, are now much used.

Bee. [AS.] A family of membrane-winged insects, of which the best known are the honey or hive bee and the humble or bumble bee. The hive bee is a busy and curious honey-gatherer, which lives in communities or colonies. A colony consists of males or drones, females or queen bees, and workers. A hive of forty or fifty thousand busy workers is all under one queen bee. She lays all the eggs, and the workers keep close guard over her. They also are females, but as a rule lay no eggs. The drones have no sting, and neither work nor defend their nest. They number about one-thirtieth part of a hive, and are all slaughtered by the workers during the latter part of summer. When well kept, bees collect more honey than is necessary for them-



LEG OF BEE.

selves and their young, and the excess is the honey used by man. The queen never works, but the workers gather the pollen and nectar from various flowers. (See *Honey*.) They have the sense of smell, for they scent the nectar or

honey at great distances; and, like other insects, they have curious compound eyes, composed of thousands of small eyes. The mouth of the bee is well adapted to the work. It has a long lip and a much longer tongue. With the latter it probes the flower-cups and licks up the nectar which in its honey-bag becomes honey. In the hive, bees gather in thick clusters, hanging from the top, the first suspended by its fore claws, and the others holding to one another by the legs. In twenty-four hours small scales of wax appear on their under parts. The workers shake the wax from their bodies or pick it out of their pouches with their feet; they then take it in their jaws, work it over with saliva, and from it build cells in double rows. These cells are called the honeycomb. Artificial wax combs are sometimes used, and the bees fill them with honey. Pollen is also gathered for bee-bread. The worker scrapes the pollen and packs it into little baskets at the middle joints of its hind legs. Bee-bread is pollen mixed with honey for ordinary food and to feed the young. Cells are hex-



agonal in shape, and so have strength and economize space. The cell of the drone is larger than the cell of the worker, and that of the queen bee is larger than either. The queen bee places a single egg in each cell—worker-eggs in worker-cells, and drone-eggs

in drone-cells. The workers seal up these cells, leaving little holes for air to enter when the young shall be hatched, while honey-cells are always sealed tight to keep out the air. The eggs become grubs or larvæ, which spin about themselves silken cocoons, and in twenty-one days after the eggs are laid, full-grown bees, both workers and drones, come forth. The queen grubs remain still in their cells, and are guarded and fed by the workers. The old queen, jealous of these royal prisoners, becomes excited, and a large number of bees fill themselves with honey, and, joining the old queen, "swarm" or leave the hive, and settling on some branch, are put into a new hive.

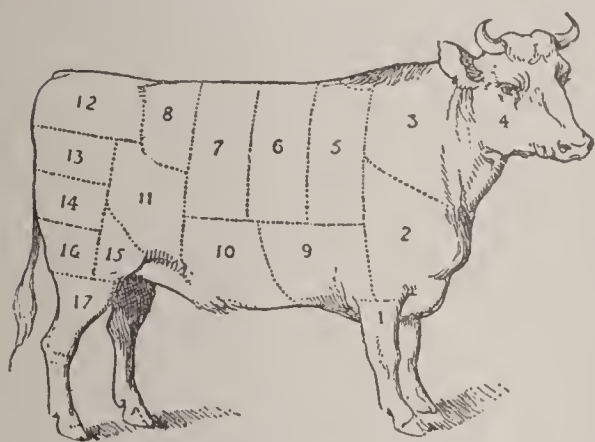
The *humble-bee* (*L. Bombus*), having a longer tongue than the honey-bee, reaches the nectar of the red clover flower, and, carrying pollen from stem to stem, enables it to bear seed. The New Zealand farmer tried to raise clover, but failed till humble-bees were imported. The humble-bee and wasp have communities like the honey-bee, but the number of the males equals the females, and the males work actively and defend

the nest. Bees fortify their nests against the sphinx moth and other enemies.

The *carpenter bee* is a solitary bee. She bores her nest in old wood in the shape of a tube, which takes a sudden turn and is continued down the trunk parallel to the grain of the wood. This tunnel she divides by sawdust partitions into cells, in each of which is placed an egg with a supply of food for the young larva. Large quantities of bees-wax are used for making candles, and also for artificial flowers and fruit.

Beech. [AS.] A tree of the *Fagus* family, growing in Europe and America to a large size. It has a smooth bark and thick foliage, and bears triangular nuts which yield an oil. These nuts are used to feed swine. The wood is made into shoe lasts, mill wheels and tool handles.

Beef. [Fr.] The flesh of an ox or cow when slaughtered for food. Beef contains fibrin and



albumen, which are good flesh-forming materials, and the value of meat is chiefly due to the presence of these two substances. The methods of cutting up

an ox into beef vary in different countries. In this country it is cut up into 17 parts—(1) shin, (2) clod, (3) neck, (4) cheek, (5) chuck rib, (6) middle rib, (7) fore rib, (8) sirloin, (9) shoulder, (10) brisket, (11) thin flank, (12) rump, (13) aitch or edge bone, (14) buttock or round, (15) veiny, (16) mouse buttock, (17) leg. Corned beef is made by soaking lean parts in a pickle of saltpetre and sugar.

Beer. [AS. *beor*; Ger. *bier*.] Under this name may be included beer, ale, and porter. The process of making beer is called brewing. Barley is soaked in water and kept in a warm place until it begins to sprout. During this process the starch in every grain of barley is changed into saccharine or grape sugar. The sprouting is stopped by drying the grains, and the barley is then called malt. This done, the malt is crushed and boiled in hot water, which dissolves the sugar. The sweet liquid so got is called wort. Hops are added to the wort. They give an agreeable taste to the beer and help to clear it and to keep it. Next a little yeast is added which causes it to ferment. Fermentation converts the grape sugar into carbonic acid gas, which escapes into the air, and alcohol, which remains in the beer. In 100 lbs. of beer there are from 4 to 8 lbs. of alcohol, $4\frac{1}{2}$ lbs. of dextrin, $\frac{1}{2}$ lb. of albuminoid matter, and from 80 to 90 lbs. of water.

Beet. [AS.] A biennial vegetable plant which produces an edible root the first year and seed the second year. There are many varieties; the red is used for the table, the mangel-wurzel

for feeding stock, and the white in making sugar. Beet-root sugar is equal to that made from the cane, and is made in immense quantities in Europe, where more than 4,000,000 tons are produced annually. This industry has been introduced into the United States, but has as yet made no great progress.

Bee'tle. [AS.] Any insect of the order *Coleoptera* (or wings in a sheath), having four wings, the outer pair being stiff cases for covering the others when folded up, and defending them from hard substances underground. The black beetle is the common large cockroach. The



curculio or weevil lives on fruit or grains; tiger-beetles are striped; carrion-beetles live on dead animals; the Spanish-fly is a bright-green beetle; stag-beetles have long jaws. The turnip-fly or flea-beetle and click-beetle are destructive to crops. There are many thousands of different species of coleoptera, and they vary very much in size and appearance.

Bego'nia. [From Michael Begon, a botanist.] A species of plants grown as ornamental plants. The leaves are curiously one-sided and often exhibit brilliant colors.

Bell. [AS.] A hollow metallic vessel shaped like a cup, with a wide mouth containing a clapper or tongue, and giving forth a musical sound when struck. Bells are made of various metals, but the best are made of an alloy of copper and tin. The large bell of Moscow is 19 feet 3 inches high; the bell of Kioto, Japan, is 24 feet high.

Belladon'na. [Bot. name *Atropa belladonna*.] A herbaceous plant with reddish bell-shaped flowers and shining black berries. Both plant and fruit are poisonous, and used as powerful medicinal agents. Also called *nightshade*.

Bel'laws. [AS.] A flat, round, double utensil, which by the rise and fall of the top part draws in air through a valve and expels it through a tube. Useful for blowing fires, ventilating mines, and filling the pipes of an organ and some other musical instruments with wind.

Ben'zene. [Arab. from *benzoin*.] A compound of carbon and hydrogen discovered by Faraday. It occurs amongst the products of the distillation of many organic bodies, but its chief source is

coal-tar. It is a thin, limpid, colorless liquid, emitting a pleasant odor. It dissolves easily in alcohol, ether, turpentine, and wood spirit, but is insoluble in water. It is of value from its great power of dissolving gutta-percha, wax, camphor, and fatty bodies. Impure benzene is used for removing grease stains from silk or woollen articles of dress.

Ben'zine. A substance derived from petroleum, which is much used as a substitute for turpentine and for dissolving oils and fats.

Ben'zoin. [Arab.] A vegetable substance obtained by drying the juice of the benzoin tree. It is brought from Siam and the islands of the Indian Archipelago. It is used in perfumery and as incense, being fragrant and aromatic, and also in medicine. A compound tincture is prepared from it, known as Friar's Balsam, and is used for dressing wounds.

Berg'amot. [It. *bergamotta*; prob. from Turk. *beg armudi*, a lord's pear.] A tree of the Orange family, having a pear-shaped fruit, from the rind of which is extracted an essential oil with a delicious and much-prized perfume called oil of bergamot. This oil is used in perfumery and in making liqueurs.

Ber'yl. [Gk. *beryllos*.] A mineral found in granite together with topaz. It is of a light-green color. It crystallizes in six-sided prisms; is very hard and difficult to fuse unless mixed with some other substance, such as borax; and consists chiefly of alumina, silica, and glucina. It is found in India, Brazil, Peru, and Siberia.

Be'tel. [Tamil.] A climbing pepper, the leaves of which, mixed with lime and areca-nut, are chewed by the inhabitants of the East Indies, and the Malays. It stains the lips red and teeth black.

Bevel Wheels. Wheels the axes of which are not parallel, but inclined at a certain angle to one another. When the axes of the two wheels are at right angles they are called *mitre wheels*.

Bi'cycle. [L. *bis*, twice; and Gk. *kyklos*, a circle.] A two-wheeled velocipede propelled by treadles attached to cranks or levers. It has become a favorite vehicle, both in Europe and the United States, from its rapidity of motion and the ease with which it can be propelled.

Bill'iards. [Fr.], The king of indoor games. It is played with balls and a cue on a table, with pockets at the sides and corners. The player seeks to impel his ball to strike or cannon two other balls, or drive another ball into the pockets. The French game is cannon only, and is played on a table without pockets. The American game is played with four different colored balls. Pyramids is played with fifteen red balls arranged in a triangle, and a white ball; in pool there are as many balls as players.

Bi'ograph. [Gk. *bios*, life; *graphein*, to write.] An instrument for the reproduction from photographs of seemingly living forms. The photographs are taken on a film in such rapid succession that every phase of movement of the figures is caught as a separate picture. To produce the effect of life the film with its successive pictures is run rapidly through a lantern arrangement,

they being thrown on a screen in such quick succession that they blend to the vision and produce a remarkable vivid representation of actual life movements.

Birch. [AS.] A tree of several species belonging to the genus *Betula*—as the white or common birch—the most widely diffused, the dwarf birch, the paper or canoe birch, the yellow birch, and the black or cherry birch. The common birch is called silver birch or lady birch; it has small green leaves, elegant drooping boughs and silver-white bark, and grows on the bleak mountain side. From the bark of the common birch an oil is obtained which is used in the preparation of real and imitation Russian leather; also a resinous substance called birch camphor or betulin is got from the outer bark of the tree. The birch of Jamaica is a kind of turpentine tree. The dwarf birch is a mere bush, and is the last shrub found on drawing near the eternal snow of the pole. Dye is prepared from birch leaves; and the wood makes good charcoal for gun-powder, and is used for smoking hams and fish. The wood is used by cartwrights, upholsterers, and turners; and the bark being impervious to water, is used for canoes and for preserving roofs. An oil similar to winter-green oil is prepared from the black birch.

Bird. [AS.] A winged vertebrate animal covered with feathers. Birds easily mount up into the air, their bones being of all animals largest in proportion to their weight, and the quills of



their feathers filled with air. These communicate with a series of sacs or air-chambers connected with the lungs. In birds which fly much the neck

is stretched forward like a wedge, the breast bone is extended like the keel of a ship, and the wish-bone, which is the collar-bones joined into one, is much developed. In birds such as the ostrich, which run chiefly, the wish-bone does not grow. When a bird perches and bends its knees, the weight of its body pulls a large ribbon-like cord in its leg, which makes its toes clutch the perch. As it sleeps its body falls forward; and the further forward it goes, the closer do the toes cling, so that it does not fall off. The heart of a bird has four chambers, with perfect circulation. The temperature of the blood of birds is very high (104°) while that of the human body is 98°. Their bodies retain this heat through the non-conducting nature of the down and feathers with which they are covered. Feathers (*q. v.*) are modified hairs, and are shed annually. Birds are then said to moult. The bones of the neck vary in different birds. The sparrow has nine, the swan has twenty-three.

The necks of birds are thus flexible and strong, and their heads may be turned easily, or put under their wings when they go to sleep. The back-bone of a bird is inflexible, and practically one bone. The place of teeth in animals is taken in birds by the horny growth called the beak (*q.v.*) Tropical birds have the most beautiful plumage. Birds usually migrate in flocks to warmer countries on the approach of winter, returning in spring, many of them being very swift in flight. All birds build nests in which their eggs are laid and their young hatched, the young being cared for in the nest until able to fly. Birds' nests are made of a great many different materials—such as straw, sticks, hay, moss, leaves, clay, wool, hair, and feathers. The outside of the nest is rough and strong, for it has to keep out the wind and the rain. The inside is generally soft and warm, like a bed. The nests of different species of birds vary greatly, from the neat little nest of the wren, with a hole in the side for an entrance, to the hole in a tree in which the woodpecker lives, the swallow's nest of dry mud, and the eagle's nest of woven sticks. Some birds build their nests in trees, some in bushes, some in hedges, some among the grass of the field, and some in the corners of windows and under the eaves of houses. Birds are classified according to their beaks and claws, which vary greatly with their habits. There are swimmers, waders, runners, scratchers, climbers, perchers, and birds of prey. (See *Beak, Claw, Feather, Foot, Wing.*)

Bird of Paradise. A perching bird allied to the bower-birds. It has wonderfully beautiful plumage and remarkable tail-feathers, which are much prized for ladies' hats. There are twenty kinds. They live only in New Guinea and the adjoining islands.

Bis'cuit. [Fr. *bis cuit*, twice baked.] Originally biscuits, which belong to the class of unfermented bread, were deprived of their moisture by being twice baked; but although that process is no longer employed, the name is retained. Ship biscuits are made of wheat flour, from which only the coarsest bran is separated. Fancy biscuits are made from fine flour, to which eggs, are added with ginger, almonds, or other spices. (See *Bread.*)

Bis'muth. [Ger.] One of the metallic elements. It is found in small quantities, in the native state, in Cornwall, France, Germany, Peru, and Siberia, but is chiefly prepared from its ores, which are found in Saxony and Cornwall. Pure bismuth crystallizes more readily than any other metal, and its density decreases under increased pressure. Fusible alloys containing bismuth have been to some extent used as safety-plugs for steam boilers, in addition to the safety-valve. The compounds of bismuth are also used in medicine and as pigments.

Bi'son. A large animal of the Ox family, of which only two species remain, one in America and one in Europe. Its most striking difference from the ox is in the hump behind the neck, the

longer limbs and shaggy head and shoulders. The American bison, commonly but wrongly called buffalo, was formerly very abundant, but has been nearly exterminated. Of the European bison only one herd remains. The bison is about 10 feet long, 6 feet high, and is very strong.

Bit'tern. A wading bird of the Heron family, now very scarce in England. It has a *booming* cry, which when heard at night sounds so dismally that the bird has been named the night raven. The American bittern is called the stake-driver or meadow-hen.

Bitu'men. [L.] A combustible mineral which emits a strong odor when burning. It is supposed to have been produced by the action of heat on coal, and is essentially the same as petroleum and naphtha.

Black'berry. The fruit of the prickly bramble bush, called in England the brambleberry. The plant is of the same family as the raspberry. It grows all over Europe and Asia, and is abundant in North America. In the United States are the high-bush and low-bush blackberries, and the creeping dewberry, all growing wild. There are also several cultivated varieties, bearing larger and finer berries. The fruit is eaten for dessert, made into jelly, jam, and preserves, and wine and brandy are made from it.

Black'bird. A singing bird which is a species of thrush. In England it is sometimes known as the merle, and its fine note makes it a favorite; but not with the gardener, who blames it for its fruit-eating propensities. In America there are the crow-blackbird or purple grackle, the red-winged blackbird, and the cow-bird.

Black=lead. The substance called by this name has no lead in its composition, but consists of graphite or plumbago, one of the forms of carbon. It gets its name from the mark it makes on paper, like that made by lead. The best known is found at Ticonderoga, New York, this being of almost pure carbon. It is used to make lead pencils, being ground and compressed into shape. It is also used for stove blacking, mixed with clay to form crucibles, which have to stand great heat, and for other purposes.

Black=snake. A species of snake common in the United States and one of the largest found there, measuring sometimes over six feet in length. It is of a leaden color, is very swift in its movements, and readily climbs trees. Though it bites readily, it is not poisonous, and is an enemy to the rattlesnake, which it coils around and crushes to death. It feeds on small animals, seeks eggs in the poultry-yard and milk or cream in dairies. It is easily tamed.

Blank'et. [Fr.] A heavy, loosely-woven stuff, usually of wool, and having a nap, used in bed-clothing, as a robe, or as a cover for a horse.

Blast=furnace. A furnace for smelting ores into which air is forced by pressure. The terms *hot blast* and *cold blast* are used to indicate whether the current is heated or not heated before entering the furnace.

Blast'ing. The blowing asunder of rocks or other



BLAST FURNACE.

hard material by means of explosives. In this work gunpowder is now largely displaced by the more powerful dynamite or other newly-discovered explosives. Blasting holes are now largely made by steam-drills instead of by hand, and the electric spark is much used in exploding the charge. Some of the new explosives are exceedingly powerful in their rending effect.

Bleach'ing. [Fr.] The process of removing the color from textile fabrics and from many other materials used in the arts, such as oil, wax, and the various substances used in paper-making. The old method of bleaching was carried on by exposing the materials to the action of the sun's rays, while they were kept damp by frequently sprinkling them with water; but since the discovery of the bleaching action of chlorine about one hundred years ago by Berthollet, a French chemist, bleaching has become a thoroughly scientific process. The two chief bleaching agents are bleaching-powder (or chloride of lime) and sulphurous acid.

Blood. [AS.] The vital fluid of animals, which circulates through tubular vessels known as arteries and veins. This fluid is largely water, but contains the nutriment derived from the food we eat. The arteries carry the bright-red blood which feeds the system. The veins bring back dark-colored blood, filled with waste substance from the body. Arterial blood is bright red and life-giving. Venous blood is black-looking, and destructive of life until purified by the lungs (*q.v.*) From the extremities of small arteries the blood enters the thread-like capillaries, where nutrition takes place. These capillary tubes convey the blood to every part of the muscles and bones, to the root of every hair and every part of the brain, and throw it into the veins, so that it may go back to the heart (*q.v.*). Blood, though red in appearance, is a clear liquid without color, in which are particles or corpuscles so minute that the aid of a powerful microscope is required to examine them. Some corpuscles are red, others are white, but the red are so numerous as to tinge the fluid red. Oxygen from the blood unites with particles of tissue, and burns them, causing both the heat and the motion of the body. Exercise makes us warm, because the air is inhaled more rapidly, and the blood passes more rapidly through the lungs in contact with it, and so more oxygen is introduced into the body. The blood circulates through the body once in about two minutes, or about 12 lbs. of blood pass through the heart every minute. Every time the heart contracts it sends a fresh

supply of blood to the blood-vessels, and the motion gives a pulsation to the system. This is distinctly perceived at the pulse in the wrist, because there a rather large artery lies near the surface. The temperature of the human body is 98° , that of birds is 104° , and that of fish is 85° .

Bliz'zard. A winter storm common on the western plains of the United States, its characteristic being a strong and very cold wind and fierce blinding snow. It usually appears in the Canadian plains, following a very low barometer, and spreads over a wide area. Blinded by the snow, many people lose their lives. In the blizzard of January, 1888, about 235 people perished. Blizzards rarely visit the East, but on March 12, 1888, one occurred in the country about New York and Philadelphia which made all roads impassable and stopped railroad travel for nearly a week.

Block-system. A system for the control of railroad trains so as to avoid collisions. Block stations are placed a few miles apart, connected by telegraph lines, and provided with signal boards or lights. The rule is that no train shall pass a block station while a train is on the section in advance, and until word comes back that the section is clear. Thus, if operated perfectly, there can be only one train on a section of three or four miles at a time, and collisions would be impossible. But men are not always to be trusted, and an automatic block system, in which the trains themselves work the signals, through electric attachments, is being introduced. The block system was first introduced in 1851, and is now much more common in Europe than in the United States.

Blow'pipe. A tube for blowing a jet of air into the flame of a lamp, a fire, or a gas-jet, in order to obtain a high temperature by rapid combustion. It is used in glass-blowing, in soldering metals, and in analytical chemistry and mineralogy.

Blue'bird. A small song-bird very common in spring in the United States. It lays five or six pale-blue eggs, and hatches several broods in a season.

Blue'fish. A large voracious fish, valued for food, and widely found on the American coast. It is called there the horse mackerel.

Bo'a Constrict'or. [L.] A large and powerful serpent of tropical



America, sometimes twenty or thirty feet long. It has a succession of spots, alternately black and yellow, along the back. It kills its prey by winding it within its folds and crushing it by

its muscular strength; but other serpents in Asia and Africa which crush their prey are also sometimes called by this name.

Bob'bin. [Fr.] A spool or reel, of bone or wood, with a head at one or both ends, and a hole bored through its length. It is used to hold yarn or thread in a shuttle, as in spinning or warping machines, looms, and sewing-machines. Bobbin lace is made on a pillow with bobbins.

Bod'y. [AS.] The material part of a living being. In the higher animals it is composed of a *head*, a central part or *trunk*, and four *limbs*. When the human body is dissected, or taken to pieces, there is found a hard part or skeleton, composed of about 240 bones; upon these bones lie masses of red flesh (muscles), by which the bones are moved; on the outside of all is a covering called the *skin*. The limbs are solid, but the trunk and head are hollow, containing certain organs, each of which has its allotted duty or function to perform so long as the body retains life. The muscles are called the organs of locomotion, because it is by their aid that we move about from place to place. The chief organ in the head is the *brain*, contained in the bony box called the skull. The trunk is divided, horizontally, into an upper portion (called the *chest*) and a lower portion (known as the *abdomen*). The organs within the chest are the *heart* and the *lungs*. In the abdomen are situated the *stomach*, the *intestines*, the *liver*, the *pancreas*, the *spleen*, and the *kidneys*.

Blow'ing-mach'ine. An apparatus to produce a blast of air. The blacksmith's bellows is one of the earliest forms of these. Various machine-blowers are now in use, which give a very powerful blast, some of them being rotary machines, others utilizing the steam jet to produce a blast. Another form of blower is the electric fan, with rotating vanes, used to keep the air in motion in stores or offices. Powerful fans are used for the melting of iron in cupolas, and air blasts are turned into smoke-stacks to make a powerful draft for locomotives, steam fire-engines, etc.

Boar. The wild form of the common hog. It is a large and strong beast, of four feet or more in length, while the male has dangerous canine teeth. It hides by day and roams at night, doing great damage to crops and young trees. It is hunted on this account, and also for its flesh and bristles, but often proves a dangerous enemy. In some parts of India "pig-sticking" is the favorite sport.

Bog. A tract of land covered with peat, which holds much water and converts it into a kind of quagmire. It is sometimes called Peat-bog, Peat-moss, or Moss, to distinguish it from other kinds of swamp. Bogs of wide extent occur in Northern lands and they cover a considerable part of Ireland. Some bogs are more than 40 feet in depth, and are dangerous to traverse in wet seasons. (See *Peat*.)

Boil'er. A vessel in which water is boiled to produce steam, for engine purposes. It is usually a large, cylindrical receptacle of iron, though boilers are frequently made of tubes, where rapid steam-making is desired. The boilers in use to warm buildings are commonly made of wrought iron, though copper is sometimes used.

Boom'erang. A peculiar missile used by the savages of Australia in war or the chase. It consists of a piece of hard wood of a bent form and about two feet long. One side is flat, the other convex in shape. When thrown it has a singular motion. Instead of going forward it rises with a whirling motion, then begins to go backward, and strikes the ground behind the thrower. The Australians are very skillful in the use of this singular weapon, and can make it strike where they wish.

Boil'ing. When water or any other liquid is heated in the open air, its temperature rises. After a time bubbles of vapor are formed and reach the surface, and at this stage boiling or ebullition has begun. The heat converts the water from the liquid state into the state of gas or vapor, which rises in bubbles and passes off into the air as steam. The temperature at which boiling begins is called the *boiling-point*. Different liquids have different boiling points,—that of water being 212° F.; of alcohol, 173.12°; of mercury, 662°; and of acetic acid, 243.14°. These are the temperatures needed at sea-level. At higher points, where the pressure of the atmosphere is less, the boiling point is reached at lower temperatures.

Bolt. [AS.] A strong pin of iron or other material used to hold something in its place, often having a head at one end and a screw thread cut on the other, on which a movable piece called a nut is screwed.

Bone. [AS.] A firm, hard substance, of a white



THE ULNA.

THE HUMERUS.

THE SCAPULA.

or pale rose color, composing the skeleton or firmer part of the body. There are 246 bones in the human body. They give shape and firmness

to the body, protect the organs from injury, and afford a solid place for the attachment of muscles. All bones are curiously fashioned, and beautifully adapted to their various purposes. Where the object is to protect, the bone is strong and thick, and offers the greatest resistance with the least material, or is so placed as to defend the organ. Those designed for support are thick and solid. Long bones are hollow, and contain marrow, which is composed chiefly of blood-vessels and fat. The other bones are spongy and lattice-like inside, and hard on the outside. Bones are full of fine tubes through which the blood passes. The bones of the various animals vary in their texture, and are chiefly composed of phosphate and carbonate of lime and gelatine. Bones are covered with a tough membrane, except at the joints, where they are covered with cartilage. When this cartilage is removed the bone dies. The bones of the trunk are the pelvis, spinal column (see *Backbone*), the ribs, the breast-bone, the shoulder-blade, and the collar-bone. The bones of the arms are the humerus, the ulna, and the radius. The wrist has eight bones and the palm of the hand five. The bones of the legs are the femur, patella, tibia, and fibula. The ankle has seven and the body of the foot five bones. The skull is composed of a number of bones, which surround and protect the brain (*q.v.*).

Bo'rax. A compound of boron with sodium and oxygen, is obtained chiefly from Tuscany, and is found also in Tibet, China, Nevada, and California. It is used in soldering gold and other metals, and in the arts as a flux. Dyers use it to give a gloss to silks. It is employed also in medicine, and as a cosmetic. It is valuable as an insecticide, being fatal to roaches, and is much used in preserving meat, fish, butter, and milk.

Bore. [Ice.] A tidal flood which rushes into certain rivers of peculiar configuration, and is dangerous to shipping, as at the mouth of the Amazon, the Hoogly, and the Tsien-tang; also the flow of the tide in the Bay of Fundy and in Hang-chow Bay.

Boul'der. [Dan. *buldre*.] A mass of rock chiefly rounded, that has been transported by the action of ice and other natural agencies from its native bed. *Boulder clay* is the unstratified clay deposit of the glacial or drift period, and often contains large numbers of boulders. (See *Glacier*.)

Bow. [AS.] Anything bent in the shape of a curve, as a rainbow. A weapon made of wood or elastic material, with a cord connecting the two ends, by means of which an arrow is propelled.

Box. [AS.] A tree or shrub which grows in various parts of the world. The common box has two varieties. The dwarf box is used as an edging for gardens. The wood of the tree kinds is hard and smooth. It is extensively used by turners, engravers, and mathematical-instrument makers. Also a wooden case or receptacle.

Brace. [Fr.] A cord, ligament, or rope for holding anything tightly. Any piece of material

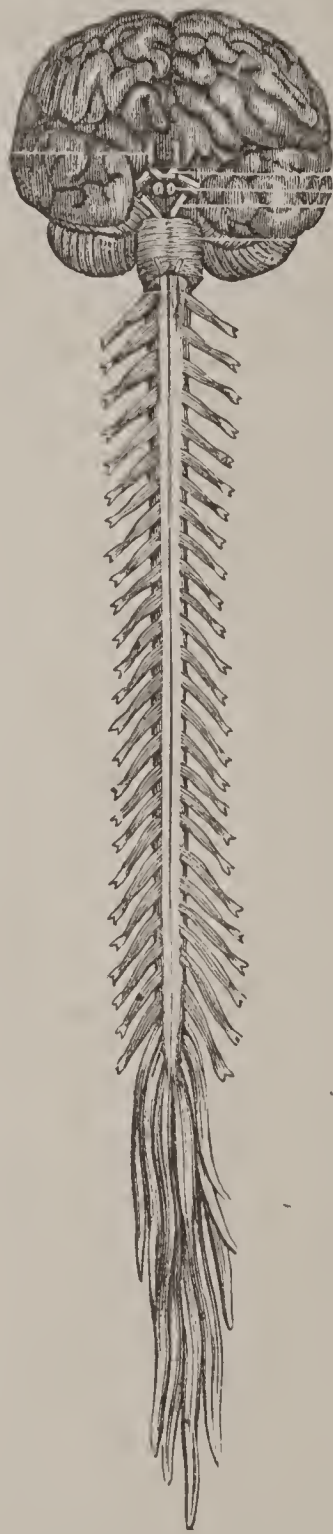
used to transmit or change the direction of a weight or pressure. In the plural, straps to sustain trousers.

Brad'awl. [AS.] A straight awl with chisel edge, used to make holes for brads, or thin nails with a slight projection at the top instead of a head.

Brain. [AS.] The brain is the principal nerve centre, and occupies the whole cavity of the head. It is carefully enclosed by membranes, its upper part being called the cerebrum, and its lower part the cerebellum. The interior mass of the brain is composed of white matter, but the entire surface has a thin gray covering. The surface of the cerebrum is made up of irregular rounded ridges or convolutions. The greater the number and depth of the convolutions, the greater the amount of brain surface, and the greater the amount of gray matter which covers the surface. It is supposed that the gray matter increases with study or thought. A deep indentation extending from front to back divides the brain into parts, so that in reality the brain is double, corresponding to the pairs of the external portions of the body. The two halves are connected by a central mass of fibres. From the nervous mass within the skull twelve pairs of cranial nerves extend to different parts of the head and face. From the brain the spinal cord extends downward through the spinal column to the lower extremity of the body. In every action which comes from thought, the mind, through the brain, with its outgoing nerves, directs the first steps, and the brain is regarded as the organ of intellect and the seat of the soul.

Brake. [AS.] A mechanism for retarding or stopping motion through friction by the pressure or rubbing against wheels, or of clogs or ratchets against a rail, or of a pivoted lever against a wheel or drum in a machine. An air-brake operates by compressed air contained in an iron box on the engine connecting with the wheels of railroad cars.

Bran'dy. [Ger. *branntwein*.] A strong alcoholic liquor, distilled chiefly in France from wine. When wine is heated in a close vessel, the alcohol arises out of it as vapor. If the vapor be



made to pass through a tube surrounded by cold water, the alcohol will be condensed to a liquid, which is brandy.

Brass. [AS.] An alloy of two parts of copper and one of zinc. Prince Rupert's metal, used in jewelry, has from 75 to 80 per cent. of copper. The alloy used in Dutch metal has 85 per cent. of copper. It is much used for machinery, telescopes, buttons, screws, etc.

Brazil-nut. The fruit of a large tree, found on the Orinoco River, South America. The nuts, which are known commonly as Cream Nuts, are three-sided, with hard shells, and white meat which is very good when fresh, but soon spoils from its abundance of oil. The nuts are packed in a smooth round case, half as large as a man's head, twenty or thirty of them in one case. They fall when ripe, rendering it dangerous to pass under the tree at that time. The monkeys are very fond of them, fighting for the nuts and throwing down the cases to break them.

Brazil-wood. A red dye-wood, brought from Brazil, and used in dyeing silks, the dye being got from the wood by boiling. Brazil got its name from this wood, which the Portuguese called *brazo*, or glowing embers, from its red color.

Bread. [AS.] An important article of food made from the flour of wheat or other grains. In the process of bread-making from 50 to 60 per cent.



BREAD-FRUIT.

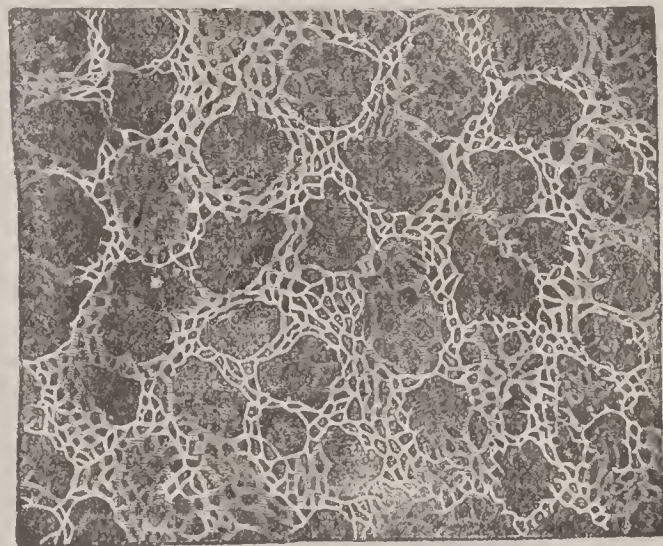
of water is added to the flour, in which yeast or other leavening matter is mixed. The yeast causes the dough to ferment, in which process the starch of the flour gives off carbonic acid gas. This forces the dough to swell, and fills it with a great number of air cavities, making it what is called light. The dough is then divided into loaves, and again left to stand, and again it swells. The loaves are then put into the oven, when the moisture evaporates and they swell, while a yellow crust begins to form on the surface. They are baked in the oven till the bottom

crust is hard. The acid is driven out of the dough by the heat of the oven. Aerated bread was invented by Dr. Daughlish of Maivern. It has no leaven, but has carbonic acid gas forced into the dough by machinery. The mixture and kneading are also done by machinery. (See *Biscuit*.)

Bread-fruit Tree. A native of the South Sea Islands which bears a large, nearly round fruit, the size of a child's head. The pulp, when not quite ripe, is white and mealy, and is baked for food. It has little taste, but is very nutritious. The tree has been introduced into the West Indies and South America.

Break'water. A bank of stones or a structure of timber, built to break the violence of the sea before its entrance into a roadstead or harbor. A great quantity of large stones are usually sunk, and the bank which they form is built upon with large blocks of artificial stone. In some localities breakwaters of immense size and extent have been built.

Breath'ing. The act of respiration. The organs concerned in breathing are the nostrils, the wind-pipe and the lungs. The wind-pipe is a stout tube, divided below into two tubes, one of which goes to the right and the other to the left lung. When the ribs are elevated and the diaphragm is depressed, there is a tendency to produce a vacuum between the lungs and the wall-chest. The air forces its way into the air-passages of the lungs, and expands the lung tissue so that it fills the enlarged space within the chest. This is inspiration. When the ribs and diaphragm return to their passive condition, the pressure of the air ceases, and the elastic tissue contracts, forcing



AIR-CELLS AND CAPILLARIES OF A HUMAN LUNG (MAGNIFIED).

the air out. This is called expiration, and the whole act respiration. At every inspiration we draw into the lungs rather more than half a pint of cool, fresh air. At every expiration we send out the same quantity of hot, foul air. Air that has been breathed once is found to have lost about one-twentieth of its oxygen, and to have gained as much carbonic acid gas. Such air is not fit to be breathed again. While we are in the open air there is little fear of our being compelled to breathe the same air twice ; but in

rooms it is necessary to see that there are openings for the impure air to pass out, and other openings to allow fresh air to get in. If we reckon that we breathe fifteen times per minute, it can be readily calculated that an ordinary adult takes into his body from the air, by means of his lungs, $1\frac{1}{2}$ lbs. of oxygen daily, and gives to the air a rather greater amount of carbonic acid gas. The frog has no ribs, but simply closes its lips and swallows the air which is in its mouth. Turtles swallow the air in the same way as frogs. Fishes get all the air they need from the water, which enters freely at the mouth and passes over the gills, and escapes at the gill slit—the oxygen from the water being absorbed by the blood of the gills. A fish out of water dies for want of oxygen, which it can take from water but cannot take from air, and so it is suffocated by air. Lobsters breathe only by gills, which are situated in a cavity under the body and attached to the legs, the action of the legs and of a spoon-shaped appendage causing a current of water to pass over the gills, which absorb the needed oxygen. Insects breathe by air-tubes that pass through every part of their body, and open on the surface of the body in small holes, which exclude water or dust, but admit air. (See *Lungs*.)

Brick. [Fr.] A mass of clay which is converted into building material by burning. The clay is dug up, exposed to the air and frost, and kneaded or mixed with water until it is a thick paste, and then moulded into bricks, which are called green or raw bricks. A brick-making machine will turn out from twenty to thirty thousand green bricks a day. These are burned in large ovens or kilns. The color of bricks depends on the proportion of iron they contain; red bricks have much iron, and cream bricks have little iron in them. Terra-cotta is a very fine clay of a delicate red color, made into bricks, urns, and statues. Bricks are used for buildings of all kinds, and are cemented by mortar made of sand and lime.

Bridge. [AS.] A roadway over a stream, valley,



or low ground. *Viaduct* is applied to bridges over which a road or railway passes; and *aqueduct* is applied to those for carrying a canal or

water. They are made of wood, stone, iron, or steel. Bridges are built in various ways. In shallow water they are supported from the bottom, or stone piers are built, and arches thrown from pier to pier. Suspension bridges are held up by strong strands of wire stretched from shore to shore. A common way of building bridges now is by truss or girder work, the bridge being sustained by iron girders firmly bolted together. There are many remarkable bridges in existence, some of them of great length and width and able to support immense weights.

Britan'nia Met'al. [From *L. Britannia*, Great Britain.] An alloy of tin, antimony, and copper. It varies in composition, but in general it contains from 80 to 90 per cent. of tin, with varying proportions of the other two metals. It is used for the manufacture of numerous articles for the table, also as a basis for electro-plating.

Bronze. [Fr.] An alloy of copper and tin, with a small quantity of zinc added. Bronze is used for statues, ornaments, bells, cannon, coin, etc. Turkish gongs and cymbals are made of a bell-metal plunged while hot into cold water. Hard bronze is obtained from 7 of copper to 1 of tin; while soft bronze, which bears rolling and drawing, contains 16 of copper to 1 of tin. Bronze for bells generally contains a little zinc and lead. Copper with 10 per cent. of aluminium yields a handsome golden yellow alloy, known as *aluminium bronze*, and much in use for various purposes.

Broom. [AS.] A low shrub with long, straight, green angular branches, minute leaves, and yellow flowers. The twigs, when tied together, are suitable for making brooms to sweep with.

Brussels=sprouts. A plant of the Cabbage family, which produces in the axils of the upright stems numerous small green heads or *sprouts*, each a cabbage in miniature.

Buck'wheat. [*Buck*, a beech tree; and *wheat*.] A plant of a family which includes knot-weed, called also Saracen wheat, with a triangular seed shaped like beech-nuts; when ground it is used in America for griddle cakes, in France for bread or as gruel. In England it is sown as food for pheasants, to decoy them from their covers. Its flowers yield excellent honey, of which bees are very fond, and it is often planted in the United States for this purpose.



Bud. [AS.] The rudiment of a branch, a leaf, or a flower. In biennial and perennial plants buds are formed towards the close of the growing season in the axils of the leaves. Terminal buds are those at the end of branches, and lateral buds are those at the sides. Buds are usually protected from the frost during winter by a covering of scales. The buds of plants growing in tropical countries have no special covering.

Buf'falo. [Span.] A ruminant animal of the Ox family, found in Southern Asia and Europe and in South Africa. The buffalo of Asia is a native

of the East Indies, but has been introduced into other countries as far west as Italy. This animal is fond of water, and during the heat of the day lies in water sunk up to its nostrils. It covers itself with a coating of mud, as a protection against insects. It has long been domesticated and used as a beast of burden, and is the farming animal in the Philippine Islands. The Cape buffalo inhabits South Africa, and is regarded by hunters as very fierce. Its horns are very broad at the base. Buffalo-horn is used for combs, drinking cups, and knife and fork-handles. The American bison is generally called buffalo. (See *Bison*.)

Bug. [Celt.] A general name applied to various insects, as squash-bug; but specially also the bed-bug. Also, loosely, any beetle, such as lady-bug, potato-bug, etc.

Bu'gle. [Fr.] A copper musical instrument for calling hounds or for summoning soldiers, first made from the horn of a wild ox. In bands the bugle is now superseded by the cornet.

Bull'finch. A European cage bird allied to the grossbeak, with the breast and neck red. It may be easily taught to whistle correctly musical airs.



THE COMMON FROG

Bull'frog. The largest of the frogs, it being generally 6 to 8 inches long, and 4 inches broad. It is very common in the United States, especially in the South, and derives its

name from its loud call, which resembles the lowing of a bull.

Bun'ion. [Fr.] A swelling usually on the first joint of the great toe, caused by continued pressure of tight boots.

Bun'sen Burn'er. This burner consists of an ordinary gas-jet over which is placed a metal tube about 5 inches long, perforated with holes at the bottom. When the gas is lighted, air is drawn through the holes, and mixes with the gas before ignition. From this air a plentiful supply of oxygen is obtained to allow complete combustion to proceed at once throughout the whole flame, and thus a smokeless, non-luminous flame of great heating power is obtained. The burner is used for various purposes, such as fire-lighting, cooking, ironing, heating, and soldering.

Buoy. [Du. *boie*, a chain.] A floating mark or beacon to point out a shoal or danger, usually chained to its place. Life buoy, a float intended to keep from sinking. Bell-buoy, a buoy with bells rung by the waves.

Bur'dock. A rough wild plant, very common in Europe and the United States. It is about a yard high, has large coarse leaves and purplish flowers, and bears prickly seed burs, which catch on clothing, the wool of sheep, etc., and are

thus scattered. The leaves and their juice are of use in healing burns or the itching effect of poison ivy.

Bush'el. [Fr.] A measure of capacity of 4 pecks or 8 gallons or 32 quarts. The English imperial bushel contains 80 lbs. of water at 62° F. The United States bushel contains 77.6274 lbs. of water at 39.8° F.

Bust'ard. A bird, native to Europe and Asia, where it inhabits dry open plains. It has large wings, but rises in the air only at times. When on the wing, its flight is strong and sustained. It generally runs along the ground, and feeds on vegetable matter, worms, and insects. The Great Bustard has a long neck and longer legs, measures about 2 feet 6 inches in length, and weighs about 20 lbs. The Little Bustard is about half this size.

But'ter, [AS.] A fat contained in milk, and obtained from the cream by churning. The cream is beaten about in the churn until the skin of curd which exists around every little ball or globule of fat is broken; the particles of fat then stick together and form butter. The butter is then well washed in fresh water, to remove the small pieces of curd. A little salt is mixed with fresh butter; but if the butter is to be kept for a long time, much more salt must be used. Like all fats, butter is almost entirely a heat-giving and force-producing food.

But'tercup. [AS.] A kind of crowfoot with bright-yellow flower. It is the cuckoo-bud of Shakespeare. (See *Flower*.)

But'terfly. The most beautiful of insects, having wings covered with colored dust, which is really fine, shiny, iridescent scales. The butterfly is therefore called a scale-winged insect. Young caterpillars are hatched from the eggs of the butterfly. In some cases these eggs are beautiful, shaped like vases and caskets. They are fastened to leaves, and the mother, during her brief life, seeks to deposit them on that plant which, after the caterpillars are hatched, will afford the proper food. The eggs of butterflies lie dormant during the winter, because the cold of winter would be fatal to the young insects, and the leafless trees would afford the caterpillars no food; but the warmth of the spring soon develops the living embryo. The caterpillar is composed of thirteen rings joined together, and has six jointed legs on three of the rings behind its head, like the six legs of its mother. These remain with it through life, while the four pairs of legs on the rear part of its body disappear. The caterpillar crawls over the plant upon which it was born, devouring the green leaves. During this stage it is called a larva. After a time it ceases to eat, and becomes a pupa or chrysalis. Under its chin is a little spinner, from which issues a silken thread, with which it suspends itself, head downwards. Others hang from the tail. The chrysalis remains as if dead, but is really feeding on the fat formed in the body of the larva; and in due time the *imago*, the perfect butterfly, comes forth, dries its wings, and flies away full grown. Butterflies fly in the daytime, and when they

rest their wings are raised over their back. The antennæ stretch out nearly straight, and end in knobs. The under side of the wings often resembles in color the flower upon which the butterfly feeds. Conspicuous are the large round eyes, which under the microscope are found covered with numerous flat surfaces. These are called compound eyes, for they consist of a great number of eyes crowded into a mass. There are about

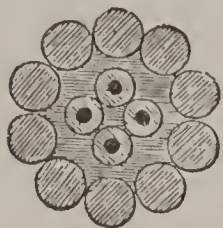
five thousand kinds of butterflies. They are great rovers, and having no homes they flit about among the most brilliant but shallow blossoms, perfecting their seeds.

Buz'zard, [Fr.] A bird of the Falcon family. There are various kinds of this bird of prey—the common buzzard, the rough-legged buzzard, the honey buzzard, the moor buzzard, the bald buzzard or osprey, the carrion buzzard, and others.

C

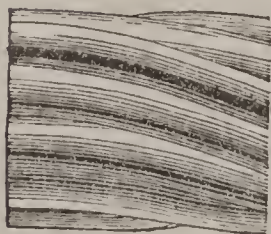
Cab'bage. [O.E., or L. *caput*.] An esculent vegetable with a foot-stalk, short, strong, and fleshy, which runs as a great rib to the point of the blade, while smaller ribs run from it to the edges. The common cabbage has a compact *head* of leaves, hence its name. It is one of the most nutritious of ordinary vegetables. Red cabbage is used as a pickle. In the Channel Islands, a tree-cabbage four feet high is grown to feed cattle.

Cab'inet. [Fr.] A safe place for jewels or paper; usually a set of drawers or a cupboard closed with doors. *Cabinet*. A private room in which consultations are held. Monarchs formerly consulted with their councillors in cabinets, hence the



name became applied to the board of councillors. In the United States it is applied to the heads of the government departments who act as adviser of the President.

Ca'ble. [Fr.] A strong chain or rope for fastenings ships or other purposes. Telegraph cable is a rope of gutta-percha, yarn, and iron wire, in the centre of which are copper conducting wires to be laid underground or under the sea. The largest chain cable, with links $2\frac{7}{8}$ inches thick, was made especially



A CABLE.

for the steamship *Great Eastern*.

Cac'tus. [L.] A kind of plant like the prickly pear, found in tropical America, usually with leafless stems and branches, and sometimes clustered thorns. (See *Cochineal*.)

Cad'dy, [E. Ind.; from Malay, *kati*, a weight of $1\frac{1}{2}$ lbs.] A small box for holding tea.

Caffe'in. [Fr.] A white, bitter, crystallizable substance obtained from coffee.

Cais'son. [Fr.] An apparatus used in laying the foundation of bridges under water. One form is an inverted water-tight hollow box with iron-bound edges, in the bottom of which some masonry has been constructed. The weight of the masonry forces the caisson into the sand and mud at the bottom, and air, under pressure, is then forced in, driving out the water and allowing the workmen to enter through the air-tight locks.

Cake. [Scand., or L. *coquere*, to cook.] A mass of dough, made palatable by the addition of sugar, eggs, fruit, and other materials, and baked

in the oven; or made into a batter and baked on a griddle. It differs in these respects from bread. Also the compressed seeds of flax, rape, and cotton. These contain much oil, which is extracted by strong pressure, leaving a compact cake of about half an inch in thickness. Oil cake is used as food for animals, half-a-pound a day being sufficient for a sheep and five pounds for a bullock. It is used in addition to grass, hay, or other food.

Cal'abash. [Span.] A tree found in tropical America, the gourd-like fruit of which has a soft pulp, and its shell is made into drinking-cups and bottles.

Cal'amus. [L. *Acorus calamus*.] The Sweet-Flag, a plant found in ditches and by the side of ponds in Asia, Europe, and North America. The root-stock yields an aromatic stimulant and tonic, much used as a medicine in the East. It is also made into confections and used in liquors in Germany. Some persons chew it to clear the voice and sweeten the breath.

Cal'cium. One of the metallic elements, whose oxide is the abundant and very useful lime. It occurs abundantly as limestone, and in its crystallized form as marble. Calcium carbonate is so abundant in nature that it is found in most natural waters, in which it is dissolved and carried to the sea. Sulphate of lime is a common constituent in what is known as *hard* water, and is found in sea water. In its solid state it is known as Gypsum, or Plaster of Paris.

Cal'culating Machine. An instrument in which, by the movement of keys, acting upon an intricate mechanism, arithmetical calculations may be made. The Babbage machine was capable of performing remarkable operations, but was of no practical use. There are simpler instruments now in use which add, subtract, multiply, and divide with wonderful speed and accuracy.

Calf. [AS.] The young of the cow and of some animals; also leather for bookbinding made from calf-skin. The flesh of calves is called veal. Calf-foot jelly is the gelatine of the feet of the calf, extracted by boiling and flavored with sugar or essences.

Cal'ico. [E. Ind.] Fine white cotton cloth, with special names, as super calicoes, shirting calicoes, unbleached calicoes. Also cotton (*q.v.*) cloth with a figured pattern.

Cal'ipers. A kind of compasses with curved legs for measuring the diameter of round bodies.

Cal'omel. [Gk.] A compound of chlorine and mercury, which is found native as horn quick-silver in Bavaria, Bohemia, and Spain. It is of great value in medicine, being one of the mildest and most frequently used of all the preparations of mercury. It is used for the liver, as an ointment, and in producing salivation.

Calor'ic Engine. A form of air engine, invented by John Ericsson, which is in considerable use for light machinery. In its working parts it resembles the steam engine, but is operated by the expansive power of hot air instead of steam.

Cal'yx. [Gk.] The outer covering of a flower. It is usually green and leafy, but in such flowers as the anemone is delicate and resembles the petals. Each leaf of the calyx is a sepal. (See *Flower*.)

Cam. [Dan.] A turning or sliding piece of machinery, which, by the side of its face or a groove on its surface, changes the motion of another piece against which it acts. Cams are used in the pin-machine, the sewing-machine, and others where varied motion is required.

Cam'bric. A kind of fine thin white linen, first made at Cambray in Flanders. Cambric muslin is thin white cotton.

Cam'el. [L. *camelus*.] A most useful ruminating animal, which for centuries has been used as a beast of burden or ship of the desert on the



sandy plains of Africa and Arabia. It is well adapted by nature for life on the desert. It can go for many days without water, being provided with a remarkable arrangement of cells in its stomach or paunch which

it fills with water, and keeps as a store for future use. Its two long toes rest on a broad, horny cushion, which enables it to walk without sinking in the sand, and its nostrils can be closed at will to shut out the fine dust of the sand-storms. The African or Arabian camel has one hump, and is called the dromedary. The Bactrian camel of Central Asia has two humps. The hump is not a part of the skeleton, but is a mass of fat which slowly lessens when the animal is on long journeys and food is scarce, it being consumed as nutriment. The camel is about six feet in height, and not very rapid in speed. It is very useful to the Arab, conveying himself and his belongings on a journey, and yielding him flesh and milk for food, hair for weaving into a covering, and hides for sandals and saddles. Camel hair is used for painters' brushes.

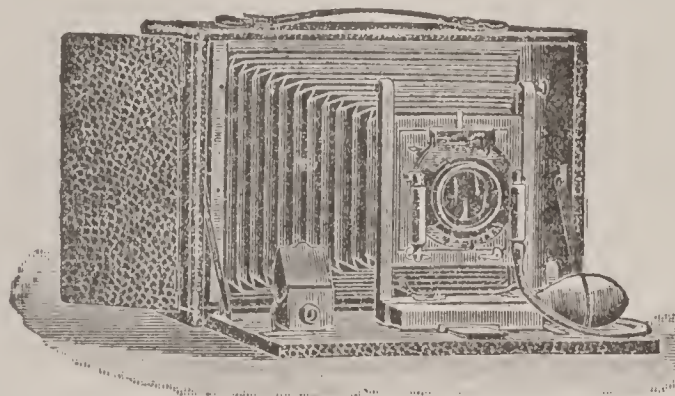
Camel'lia. [Probably named after Kamel, a Jesuit, who first brought the plant from the East.] An Asiatic shrub with shining green leaves and

showy flowers. In China oil is pressed from its seeds.

Camel'opard. [Gk. *kamelos*, camel; and *pardos*, a leopard.] An old name of the giraffe, arising from the idea that it was an offspring of the camel and the leopard.

Cam'eo. [Ital.] A precious stone, as an onyx or sardonyx, having a figure carved in relief on the surface.

Cam'era Obscu'ra. [L.] An optical instrument. In its simplest form it consists of a rectangular box fitted at one end with a lens and at the other



end with a plane mirror, inclined at an angle of 45° to the horizon. When the lens is directed to any object, the rays of light, after passing through the lens, are reflected from the mirror, and form an image on a plate of glass at the top of the box, where they may be observed and sketched. Instead of the box it is usual to have a kind of tent surrounded with curtains to keep out the light. There are various forms of the *camera* now in use for taking photographic negatives, the photographic camera being an adaptation of the camera obscura, which is fitted at the back for the introduction of a sensitized plate or film, so as to receive the image of an object or scene in front of the lens.

Cam'omile. [Gk. *chamai*, on the ground; and *melon*, an apple.] A bitter herb used as a medicine. Its flowers have a strong and fragrant smell, with an aromatic taste. Its volatile oil is used as a carminative.

Cam'phor. A white resinous substance existing in many plants, but mainly obtained from the camphor laurel, grown in China, Formosa, and Japan. The Borneo or Sumatra camphor, highly esteemed in China, is obtained from a lime tree in Sumatra, Borneo, and the Malay Peninsula. Camphor has an aromatic odor and a strong, unpleasant taste, and is soluble in alcohol and oil. Spirits of camphor is camphor dissolved in spirit. When this solution is poured into water, the camphor reappears in white flakes. Camphor is used as a medicine, and enters largely into varnishes used by painters. It is also used to kill moths and other insects among furs or woolen cloths. For a further important use of it see *Celluoid*.

Canal'. [L. *canalis*, a pipe.] A waterway made for boats or ships or for irrigation. The barrier which confines the water is called the weir or guard-lock, and the enclosure with gates at each end to raise or lower boats as they pass from one level to

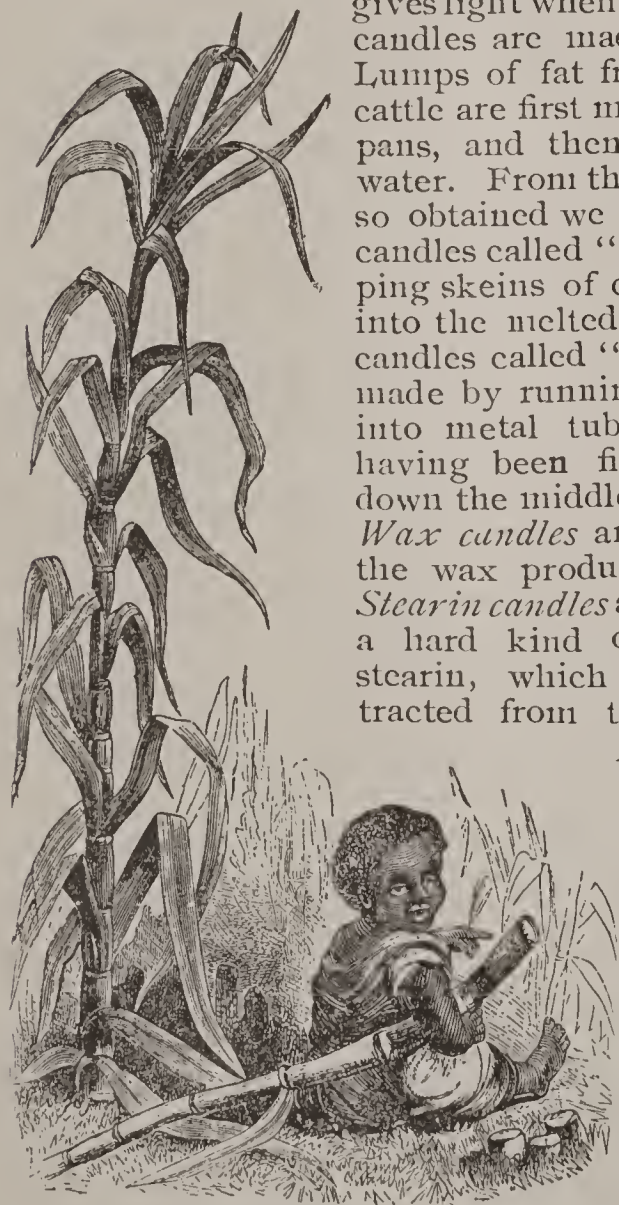
another is called the lift-lock. Most famous among canals is the Suez Canal, which was opened November 17, 1869. It is 87 miles long—66 miles actual canal and 21 miles lake—connecting the Mediterranean and the Red Seas. An effort to connect the Atlantic and the Pacific Oceans by a canal across the Isthmus of Panama has been made, but as yet without success, and it is proposed to make a similar canal across Nicaragua by the United States government. There are thousands of miles of canals in Europe and America.

Canary. A cage bird about the size of a sparrow, which is found wild in the Madeira and the Canary Islands. Great quantities of tame birds are raised in Germany. In its wild state it is generally of a dusky gray color; but tame birds are of very many different colors, those with white or yellow feathers being most valued. The tame bird is a sweet singer, some having the skylark, others the woodlark, and others the nightingale note. It is the favorite among cage birds.

Candle. [L. *candela*, a (white) light made of wax or tallow; from *candere*, to be white.] A twist of threads surrounded by tallow or wax which

gives light when lit. Common candles are made of *tallow*. Lumps of fat from sheep or cattle are first melted in large pans, and then boiled with water. From the fat or tallow so obtained we can make the candles called "dips," by dipping skeins of cotton (wicks) into the melted tallow. The candles called "moulds" are made by running the tallow into metal tubes, the wick having been first stretched down the middle of the tube. *Wax candles* are made from the wax produced by bees. *Stearin candles* are made from a hard kind of fat called stearin, which can be extracted from tallow. *Composite candles*

consist of a mixture of tallow and stearin. *Paraffin candles* are made of solid paraffin, which, like paraffin oil, is prepared from a mineral substance that oozes out of or can be ob-



SUGAR CANE.

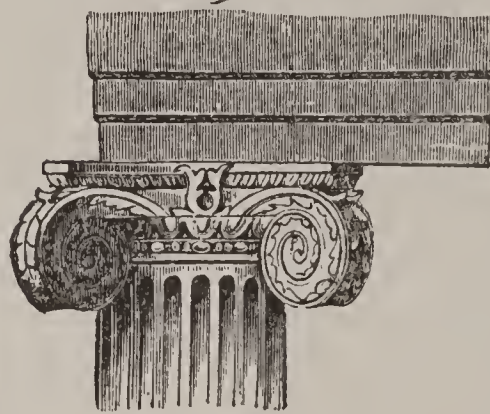
tained by heating certain rocks called bituminous shales. (See *Smelt*.)

Cane Sugar. The variety of sugar obtained from the sugar-cane and the sugar-beet, as distinguished from *grape-sugar*, which is obtained from maize and some other plants. (See *Sugar*.)

Canister. [L. *canistrum*.] A basket of reeds, or a small box for holding tea or coffee.—*Canister shot*, or case shot, a kind of shot with a number of lead or iron balls enclosed in a case which bursts when fired.

Cannel Coal. A hard, jet-black variety of coal which burns with a bright white flame. The gas yielded by this coal has nearly three-times the illuminating power of that obtained from common coal. It is hard enough to be cut and polished like jet, and is sometimes made into trinkets. In Scotland it is known as parrot coal.

Canon. [Fr. *canon*; from L. *canna*, reed, pipe, tube.] A piece of



CAPITAL.

ordnance or artillery. The large cannon now in use consists of a forged steel tube strengthened with massive steel rings shrunk upon it. Howitzers and mortars are sometimes called cannon. Cannon are distinguished by the weight of the

ball, or the diameter of their bore. Some of the great rifled guns now in use can send a heavy ball a distance of 10 or 12 miles.

Canoe. [Span. *canoa*.] A boat made of the trunk of a tree hollowed, or of bark or skins. It is propelled by a paddle or sails, and has no rudder.

Can'teen. [F. *cantine*, bottle case.] A refreshment house in a fort or barracks for the use of soldiers, where they can purchase food and other necessities, and intoxicating liquors under certain restrictions. A vessel, usually of tin, used by soldiers, in carrying water or other liquids.

Canvas. [Fr. from Gk. *kannabis*, hemp.] A coarse cloth for sieves, sails, and sacks, made from hemp, flax, or cotton, the cloth on which a picture is painted.

Caoutchouc. [Ind. pronounced *koo'chook*.] The elastic gum of several trees in South America, Africa, and Asia. It is impervious to liquids and gases, and is much used in the arts and manufactures. (See *India-rubber*.)

Capercaillie. [Celt.] A kind of large grouse with a fine flavor found in Scotland and in Northern Europe, especially Norway and Sweden, and known under the name "cock of the woods."

Capillary. [L. *capillus*, a hair.] A tube with a hair-like bore; a minute blood-vessel.

Capillary Force. The force by which water ascends in wood, sponge, blotting-paper, and other porous bodies. By the same action the flame of a lamp is fed with oil. The wick is a bundle of threads whose surfaces are nearly in contact, and the oil rises between them in the same way as if they were narrow tubes. Water is supposed to rise from reservoirs and springs below the surface of the ground to the roots of plants in the same way as it rises in fine tubes.

Capillary action seems to be due to an attraction between water and the surfaces of solid substances.

Cap'ital. [Fr.] The head of a column, and consisting of abacus, bell, and necking. The Greeks used three orders—Doric, Ionic, and Corinthian. The Romans added Tuscan and Composite. Other orders in use are Byzantine, Moorish, and Gothic. Also the seat of government of a state or a nation. *Capital letters*, heading letters, used at the beginning of sentences, etc.

Cap'itol. Originally the great national temple of Rome. A modern Capitol now stands on its site. The name has been applied to the building in which the United States Congress holds its sessions; also to the legislative halls of the States.

Cap'stan. [Fr.] A vertical drum revolving on an upright spindle with a drum-head, in which are sockets for bars or levers. It is used on board ship to raise weights by means of a rope, and is worked either by steam power or by men walking round pushing on levers in the sockets.

Cap'sule. [L. *capsa*, a chest.] A seed-vessel of a plant containing many parts or carpels, as the flax, the poppy, and the lily; a metallic seal or cover for closing a bottle; also in medicine a gelatinous envelope in which bitter doses are enclosed.

Car. [Fr.] A frame on wheels for carrying persons or loads. In the United States the word is applied to vehicles used on railroads or for street travel. Railroad cars are called *carriages* in England, except Pullman cars, train cars, etc., introduced from America.

Car'at. [Fr.] A weight of $3\frac{1}{6}$ grains Troy, divided into four parts or carat grains, for weighing gold, diamonds, or precious stones; the twenty-fourth part of any quantity of pure gold. Goldsmiths' standard is 22 carats, which consists of 22 parts of gold, 1 of copper, and 1 of silver.

Car'avan. [Per. *karwan*.] A company of merchants, pilgrims, or travelers, joined together for mutual safety and protection, in Asia and Northern Africa, with camels as the usual means of conveyance. A large covered carriage for conveying passengers or wild beasts or furniture. Shortened into *van*.

Car'away. [Bot. name *Carum carvi*.] The seed of a plant like a carrot, of the Parsley order, grown in Holland; used in confectionery and as a carminative.

Carbide of Calcium. A product of the electric furnace, consisting in a compound of calcium and carbon. It is of interest from the fact that when met it yields in abundance acetylene gas, remarkable for its illuminating powers.

Carbol'ic Acid. An organic compound derived from coal tar. When pure it is a white crystalline substance, possessing a burning taste and the odor of creosote. In the crude form it is largely used as a disinfectant. It is also applied externally to wounds and abscesses after they have been opened. Taken internally, it acts as

an irritant poison, but in small quantities it is used as a medicine. Drains and sewers are sometimes flushed with solution of carbolic acid in order to remove infectious matter.

Car'bon. A non-metallic element known only in the solid form and very widely distributed. It enters into the composition of all organic structures, whether animal or vegetable. It is found in all the animal tissues, and, with oxygen, hydrogen, nitrogen, and sulphur, makes up the whole plant—wood, leaves, and flowers. All vegetable products—such as sugar, starch, gum-arabic, alcohol, oils—consist largely of carbon combined with oxygen and hydrogen. Carbon is the chief constituent of coal; and coal, when heated so as to expel its gases, is turned into coke, which is also carbon. Carbon is also found under the form of what is often named blacklead, but which is properly called plumbago or graphite. This is the substance from which pencils are made. The diamond, though widely different in appearance from all the other forms, is pure carbon.

Carbon'ic Acid. One of the products of the combustion of carbon, also known as carbon dioxide. When coal or wood burns brightly in the fire, carbonic acid is produced, and it may be prepared artificially by acting on chalk or marble with hydrochloric acid. The air we breathe contains oxygen, which enters the blood, combines with the waste carbon of the tissues, and is breathed out again as carbonic acid. This substance is given out in large quantities from volcanoes, and from the ground in volcanic regions. It is also produced during the fermentation of wine and beer. It is one of the permanent gases of the atmosphere, in the proportion of about 4 volumes in 10,000. Plants derive it from the atmosphere and supply it to animals.

Carbonif'erous Sys'tem. In geology the system of Primary rocks overlying the Devonian. It takes its name from the extensive coal-beds which it contains. In the system there are two well-marked sub-divisions—the lower section consisting of carboniferous limestone, and the upper, of the coal-bearing division of the system known as the coal-measures. These comprise sandstones, dark shales, and seams of coal. The flora of the Carboniferous period consisted almost entirely of flowerless plants, such as ferns; and among the fauna, fossils of true air-breathing animals and various insects are found. The system is very largely developed in the United States. (See *Coal*.)

Carborun'dum. A compound of carbon and silicon, produced in the electric furnace. It was discovered in 1890 in an effort to make artificial diamonds, in which bright blue crystals hard enough to cut precious stones were formed. When powdered it is superior as an abrasive to emery and even to diamond dust. It is now largely produced at Niagara Falls, and widely used as a sharpening agent.

Car'buncle. [L. *carbunculus*, a small coal.] A precious stone of a fiery-red color, found in the East Indies—a ruby, sapphire, or garnet. A hard

and painful swelling on the skin on the trunk or back of the neck, larger than a boil, and with no central core.

Card. [*L. carduus*, a thistle.] A comb with bent wire teeth set in leather to smooth and arrange the fibres of cotton, flax, wool.

Car'dinal Bird. An American song bird or finch, with bright-red feathers and a high-pointed crest.



Ca'ret. [*L. carere*, to want.] A mark (Λ) on a line of print or writing to show that something wanting and interlined or on the margin ought to be inserted.

Car'mine. [*Fr. carmin.*] A rich red or crimson color with a purple shade, prepared from cochineal, and having acid properties.

Carp. [*Dan.*] A fresh-water fish, originally from Asia, but now in Europe, reared in artificial ponds, and latterly also introduced into America. The leather carp is almost wanting in scales, and the mirror carp has only a few large scales.

Car'pentry. [*L. carpentum*, a coach.] A work in wood for the construction of buildings. A carpenter frames and puts together roofs, partitions, and floors of buildings; a joiner makes the doors, shutters, stairs, mantle-pieces, and other parts requiring more neat joining.

Car'pet. [*Fr. carpe'te.*] A thick covering or the floor, usually of wool, but also of cotton, hemp, and straw, and made in breadths to be sewed together and nailed on the floor. Brussels carpet is made of worsted yarn on a foundation web of strong linen thread, the worsted being drawn up in loops to show the pattern. Kidderminster carpet is an ingrain carpeting chiefly made at Kidderminster, England. Tapestry somewhat resembles Brussels, the warp being printed at intervals before weaving, so as to produce the figure in the carpet. Turkish carpets and Persian carpets are made similarly with woollen threads on a linen warp, and are similar in color and in softness. Axminster carpets are like Turkish, but are made with worsted, and are very handsome. Moquette, Chenille, and Wilton are velvety carpets.

Car'riage. Motor. (See *Automobile.*)

Car'rier=pig'eon. A variety of domestic pigeon used to convey letters from a distant point to its home. It has been used in war.

Car'ronade. [From Carron in Scotland, where first made during the Peninsular War.] A short cannon without trunnions, but supported on its carriage by a bolt.

Car'rot. [Bot. name *Daucus carota.*] A biennial plant with a long tapering spindle-shaped root of a red color. It is used in soups and stews, and highly valued as a food for cattle.

Cart. [Celt.] A frame on two or more wheels for carrying loads. In excavating sand, gravel or earth, one-third cubic yard of material before it is loosened is a cart-load.

Car'tridge. [*Fr. cartouche.*] A case of paper or metal containing powder and sometimes shot for a gun. Ball cartridge contains a projectile, and blank cartridge is without one.

Ca'sein. [*L. caseus*, cheese.] An albuminous substance contained in milk, and forming the principal constituent of cheese. The casein in milk is not coagulated by boiling, like albumen; but *rennet*, or an acid, separates out the casein and butter as *curds*, leaving the milk, sugar, and salts as *whey*.

Cas'sia. [Semitic.] The pulp of the pods of a leguminous shrub in the East Indies; also the bark of Chinese cinnamon, imported as cassia and sold as cinnamon, from which oil of cinnamon is extracted.

Cast-Iron. Iron that is cast into pigs or moulds. It contains more carbon than steel, is brittle in character, but is used for many purposes. (See *Iron.*)

Cas'tor Oil. A mild cathartic oil got from the castor-oil plant (*Ricinus communis*), and used as a medicine. It is colorless, but possesses a nauseous taste. In India it is obtained in such abundance as to be used for illuminating as well as for medicinal purposes. It is greatly made in France, Italy, and the Western States of America.

Cat. [*L. catus.*] A small domestic animal, of the same family as the lion, tiger, leopard, etc. The cat is a flesh-eater, and is fond of birds and mice.



CATERPILLAR.

It has a fur coat, smooth and glossy and soft as silk; has padded feet, can run or walk noiselessly and is a good climber. The cat seeks its prey at night, having excellent powers of vision, while the long stiff hairs around its mouth are very sensitive, and aid it to find its way in the dark. There are several varieties of cats, as the Angora, Manx, Maltese, Persian, and tortoise-shell. The Persian has long, soft, silvery hair and bushy tail. The Manx cat has no tail. Wild cats feed on birds, rabbits, hares and poultry.

Cat'acombs. [Gk. *kata*, downward; *kymbe*, cavity.] Great excavations in the vicinity of ancient Rome, used for burial by the early Christians. They are cut in a soft volcanic material, and the total length of their galleries is at least 300 or 400 miles.

Cat'bird. An American bird allied to the Mocking-bird, and possessing a remarkable power of imitating the notes of other birds. Its spring song is mellow and sweet, but it has also a disagreeable note, somewhat like the mew of a cat. It is found in the eastern half of the United States.

Cat'erpillar. [Fr.] The larval state of a butterfly or moth. True caterpillars have three pairs of true legs and several pairs of fleshy legs armed with hooks. They usually feed on leaves, fruit, and vegetables. Some are called worms—as silk-worm, canker-worm, etc. After a time they surround themselves with a sheath or case of leaves, silk, or other substance, pass into the chrysalis state, and finally emerge as the mature insect. (See *Butterfly*.)

Cat'fish. A common American fish, with naked skin and eight fleshy barbules on the head. It is from 7 to 9 inches long, and is a favorite food-fish. The Great Lake Catfish, found in Lakes Erie and Ontario, is from 2 to 4 feet long, and weighs from 6 to 30 pounds. There are also very large catfish in the Mississippi and other rivers of the West.

Cat'gut. A cord of great toughness made from the intestines of animals, especially of sheep, and used for musical instruments.

Cat'kin [O.E.] The flowers of willow, poplar, and some other trees. It consists of a slender axis with many flowers wanting in petals along its sides, and is called catkin from its resemblance to a cat's tail.

Cat'nip or **Cat'mint.** [L. *Mentha cataria*.] A plant common in the United States, of whose leaves cats are very fond. They have a sharp and bitter taste. A tea made from them is sometimes used as medicine.

Cats'eye. A very precious stone which, when cut in a certain way, presents different colors, like the opal. It is so named because the eye of the cat has a similar power.

Cattle. A term denoting all animals of the ox kind. [See *Cow*.]

Cau'liflower. [Fr.] A variety of cabbage with a cluster of flower stalks and buds. It is more delicate in taste than the ordinary cabbages, and much esteemed as food.

Caus'tic. [Fr. from Gk. *kaiein*, to burn.] A substance that burns the flesh. Caustic lime is slaked lime, also quicklime. Caustic potash and soda are the hydroxides, Caustic silver or lunar caustic is nitrate of silver.

Cave or **Cav'ern.** [L. *cavus*, hollow.] A hollow place underground. Among the most interesting caves are the Mammoth Cave of Kentucky; Fingal's Cave, a basaltic cave in Staffa, Scotland; the Adelsburg caves, in Carniola; and the Luray cave, in Virginia. Many caves contain splendid stalactites and stalagmites. Mammoth Cave has

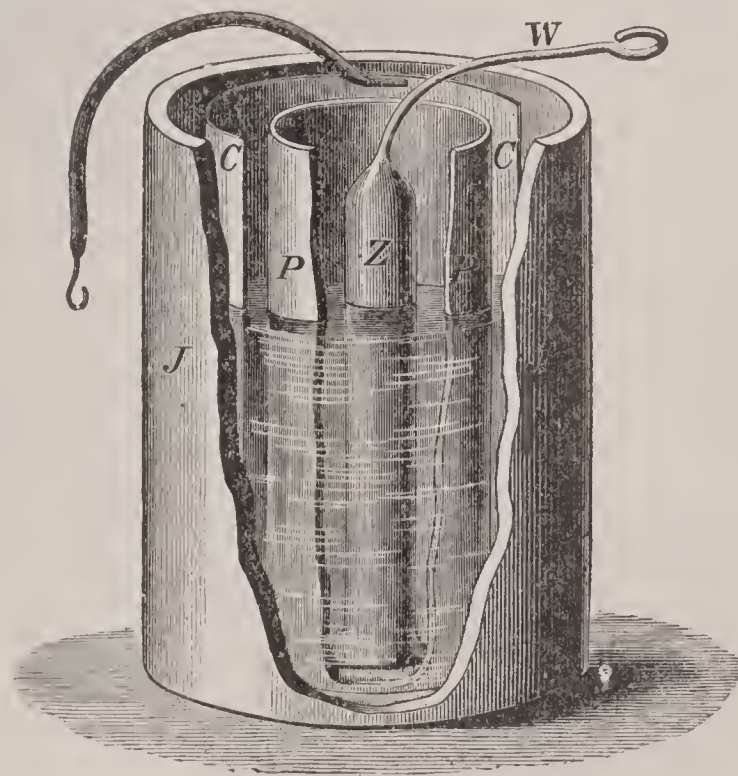
been penetrated for 10 miles, and contains a river and many splendid apartments. The greatest caves occur in limestone strata. Primitive man seems to have dwelt in caves, and bones and implements left by him have been found there.

Ce'dar. [L.] An evergreen tree with spreading branches and hard red wood with a fragrant smell. The chief varieties are the cedar of Lebanon, the white cedar, the American red cedar, the Spanish cedar. Cedar has a pleasant smell, and is much used for making chests and cabinets. The red cedar of Florida is largely employed in making lead pencils.

Cel'andine. [Fr. from Gk. *chelidon*, a swallow.] A plant like a poppy, with yellow flowers, supposed to come and go with the swallows. It is used as a medicine in jaundice and for warts.

Cel'ery. [Fr.] A vegetable of the Parsley family of which the blanched leaf-stalks are used as a relish for food.

Cell. [L.] One of the smallest parts of a plant or animal. All cells have their origin in the primary cell from which the organism was



DANIEL'S CELL.

developed. Also in electricity a jar or vessel, or a division of a vessel, for holding the fluid of a battery. Daniels' cell. Z, Zinc rod in porous pot P, containing dilute sulphuric acid; C, copper in outer vessel containing copper sulphate solution. Also a room in a prison, a sleeping room in a monastery, a small cavity or hollow place.

Cel'luloid. An ivory-like compound of camphor and collodion. It is made into knife handles, pianoforte keys, billiard balls, shirt collars and cuffs, and many other things, and used instead of glass for photographic dry plates.

Cel'lulose. A substance which is the basis of almost all vegetable fabrics. It has recently come into use as a lining for war ships to prevent the inflow of water through shot holes. It does this

by swelling when wet. A preparation was first used for this purpose made from the fibrous husk of the cocoanut, but a better article is now in use obtained from the pith of the cornstalk.

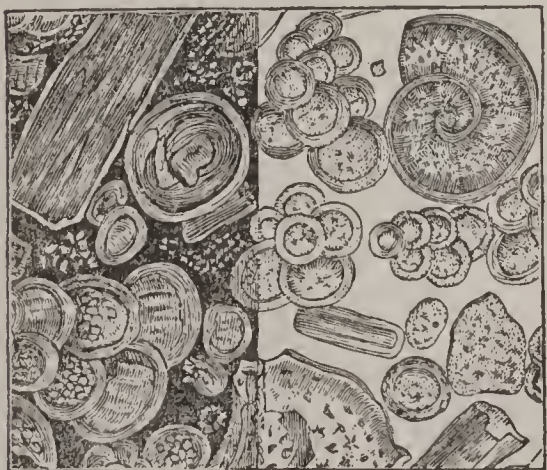
Cem'ent. The best-known cements are Portland and Roman cements, and are distinguished from mortar by hardening quickly, while mortar hardens slowly. Portland and Roman cements both *set* or harden under water; hence they are generally spoken of as *hydraulic* cements, although they are often used in superior masonry which is not intended to be covered by water. Portland cement is made of chalk or ground limestone mixed with clay or shale. Roman cement is made from a natural mixture of lime and clay. Of the natural cement stones found in the United States, the best are the Rosendale cements of New York. A cement made of carbonate of magnesia is superior in strength and hardness to all others. For ordinary cementing, plaster of Paris is very useful, and there are many cements to mend broken glass, ivory, wood, etc.

Cen'tipede or Cen'tiped. [L. *centum*, a hundred; *pes*, foot.] An animal with one hundred feet or with many feet. They are also many-jointed. Large, flat-headed, venomous kinds live in tropical countries.

Centre of Gravity. The point in a body at which we may suppose the whole weight of the body to be collected; and therefore so long as this point is supported the body will rest indifferently in any position.

Chaf'finch. [O.E.] An English song bird, said to like chaff, and valued as a cage-bird. (See *Finch*.)

Chalk. [AS.; L. *calx*.] A form of soft limestone, widely spread in parts of Europe; not found in



America. In southeast England it forms a bed nearly one thousand feet thick. If we pour a drop of vinegar on a lump of chalk, there is a bubbling up, or effervescence, which is due to carbonic acid gas escaping from the chalk. The chalk, in fact, is nearly pure carbonate of lime, which is a compound of the metal calcium with carbon and oxygen. All limestones can be detected in this way by pouring on them a few drops of some acid. Most limestones are composed of the shells or hard parts of the coral-building animals, but chalk is composed of the shells of minute swimming or floating animals, whose hard parts, after death, sank to the bottom and collected into thick layers. These were afterwards uplifted to the surface and became cliffs or

beds of chalk. Chalk is used in connection with the *blackboard* in lecture-rooms and schools. Various preparations of it are made for pastel colors. It is also used as a manure.

Chame'leon. [L.] An animal of the Lizard tribe which has the power of changing its color at will. In a dark place it is white or grayish, but when light is admitted its color changes to red, green, or brown, in accordance with the color of its location. It lives in trees, and has a very extensible tongue, covered with a sticky secretion, by which it can seize insects and draw them into its mouth.

Cham'oïs. [Fr.] An animal of the Antelope family which is found in the Alps at a height of more than 8,000 feet above the sea-level. It is like the goat in its looks and habits. Its horns are peculiar, rising straight from the crest of the head for some inches and curving backward suddenly so as to form a pair of sharp hooks. Its hind-legs are longer than its fore legs, so that in descending mountains its hind feet catch rough places and its fore feet are set close together and pushed forward. It is acute in scenting man at a distance, and footprints in the snow will alarm the wary animal. The chamois live in herds, and when grazing they post one of their number to give the alarm; but if danger comes, they see it so quickly that often they make off before the signal is given. The skin of the chamois is much valued for making chamois leather, which combines softness with tenacity. "Chamois leather," or wash-leather, is now made from the flesh side of sheep skins.

Champagne'. [Fr.] A light wine, of several kinds, originally made in Champagne, France. This wine contains much carbonic acid gas, which causes effervescence when poured out.

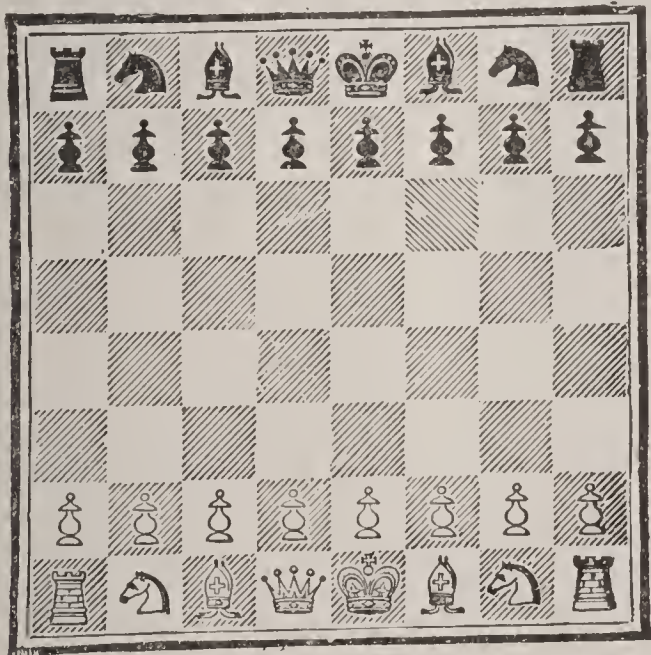
Char'coal. [AS.] The most common form of carbon. The purest form is animal charcoal, called also *bone black* and *ivory black*. It is prepared by heating bones in a vessel nearly closed; the volatile matters are driven off, and bone black is left. It is used in purifying sugar and in the filtration of water. Wood charcoal is prepared by burning wood with a limited supply of air; only the more volatile constituents burn away, and the greater part of the carbon is left. Charcoal so prepared is black and brittle; it retains the form of the wood from which it is derived. Other forms of charcoal are gas-carbon, coke, and lamp-black. It has a remarkable power of absorbing gases, and has therefore valuable uses in medicine and as a substance for respirators. It is used as a deodorant, and as a disinfectant in hospitals and dissecting-rooms. It is also largely employed in the manufacture of gunpowder.

Chart. [L., *charta*, paper.] A map especially for the use of seamen. *Heliographic*, of the sun; *selenographic*, of the moon.

Cheese. [AS., from L. *caseus*, cheese.] Curd of milk pressed hard. By adding rennet to milk, the nitrogenous substance called *casein* is made to curdle or coagulate; and it is separated from the whey by straining. The curds are pressed into shape in moulds and then dried. The best

cheese is made from new milk—that is, from milk which has not lost its cream. The richest kind of cheese made in England is called *Stilton cheese*; it is made from milk to which cream has been added. *Cheddar cheese* is made from good new milk, while some other kinds are made from milk partly or fully skimmed of its cream. *Gruyere cheese*, made in Switzerland, is flavored with herbs. *Roquefort* is made from the milk of sheep and goats. Skim-milk cheese is a flesh-forming food, because it consists chiefly of *casein*; new-milk cheese is a flesh-forming and a heat-producing food, because it contains the *casein* and *also* the milk-fat or cream. One hundred pounds of cheese contain 30 lbs. of fat. Cheese in America is principally made in large factories, largely in New York State. The annual production in the United States is about 50,000,000 pounds. (See *Curds*.)

Chem'istry. [Gk.] The Egyptians, Greeks, and Romans were acquainted with many of the substances known to us at the present day, and also with the method of their preparation; but among those nations nothing was known of chemistry as a science. During the Middle Ages the alchemists experimented with numerous substances, more especially with such as were of a metallic nature, with the object of turning them into gold. In this way they discovered some important substances. Dr. Black's discovery of "fixed air," or carbonic acid, in 1756, led the way to the discovery of other gases by Cavendish, Rutherford, Priestley, Scheele. The discovery of oxygen by Priestley in 1774 enabled Lavoisier to explain the true nature of combustion. Next came the discovery of the laws of chemical combination by Dalton, and the publication of his atomic theory. Sir Humphrey Davy, by decomposing potash and soda in 1807, laid the foundation of electro-chemistry. The



CHESS BOARD.

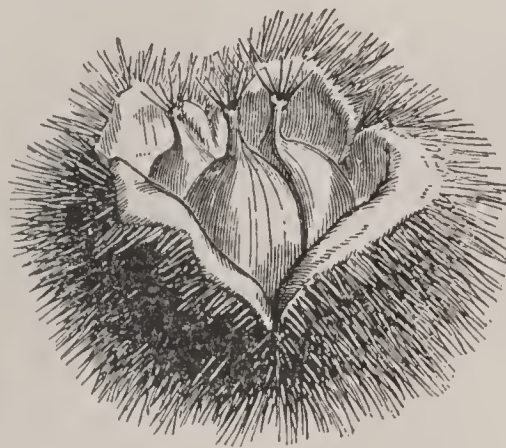
most important advances in chemistry were made during the nineteenth century, and in organic chemistry progress has been very rapid.

Cheroot'. [Tamil.] A kind of cigar originally made in Manilla; now a cigar of inferior or adulterated tobacco.

Cher'ry. [Fr., from Gk. *kerasos*] A tree of the Prune or Plum family bearing a red stone-fruit, which is much esteemed for dessert purposes and for preserves. There are several hundred varieties of the common garden cherry. The wild or black cherry of the United States is a beautiful and useful tree, its wood being much esteemed by cabinet-makers. Its fruit is not very good for eating. Cherry brandy or rum is brandy or rum in which cherries have been steeped.

Chess. [Fr., from Pers. *shah*, a king.] A game played by two persons on a board divided into squares. Each player has a king, a queen, two bishops, two knights, two castles, and eight pawns. The king, when made prisoner or checkmated, is assumed to be dead, and the game ends. There is no game requiring more skill.

Chest'nut. [Fr., from Gr. *kastanon*, a chestnut.]



A tree with white or red flowers like spikes, and a fruit of a reddish-brown color, enclosed in a green prickly husk, the nuts being covered by a thick firm skin. The timber is hard and lasting, and used for ornamental work, furniture, etc.

The bark is used in tanning. The chestnut is found in Europe, America and Japan. The European chestnut bears a much larger fruit than the American, but not so sweet. Its starchy contents are used for bread-making in Italy.

Chick'weed. The name of several weeds, especially *Stellaria media*, the seeds and buds of which are a favorite food of small birds.

Chic'ory. [L. *cichorium*.] A common European plant, known also as *succory*. It is somewhat like the dandelion, and a substitute for coffee is obtained from its root by roasting and grinding. It is mixed with coffee or used by itself. Chicory can easily be distinguished from coffee by placing some of it in water. It rapidly sinks, and colors the liquid a reddish-brown; but genuine coffee floats, and does not color the water. The chicory or succory plant grows on limy soils and by the dusty roadside. It has large bright blue flowers and toothed leaves. It is introduced in America where the blue and white-flowered varieties are common.

Chil'blain. [AS.] A swelling produced by the exposure of the hands or feet to cold and sudden heat.

Chimpan'zee. [Fr.] A West African ape which is more like man in some ways than any other ape. When full grown it is 4 feet high. It has no hair on the hands and face, and none on its large rounded ears. Its arms are shorter than the orang's, but fall below the knee. Its habit in walking is to bend forward and rest on the hands. When tamed it has been taught to eat food with a spoon at a table, but in the wild state it lives among the branches of trees near the ground.

Chi'na. A fine kind of ware first made in China, and first brought from China in the seventeenth century. (See *Porcelain*.) China ink is India ink.

Chinchil'la. A South American rodent like a squirrel, with five-toed fore feet and four-toed hind feet, and a large bushy tail. Its soft fleecy fur is much valued. It is a shy animal, with nocturnal habits.

Chine. [Fr.] A piece of the backbone and surrounding flesh of an animal cut for cooking.

Chintz. [Hind.] Cotton cloth printed with colored patterns, and often glazed. (See *Cotton*.) Chintz is used for bed-hangings and to cover furniture.

Chip'munk. A small American squirrel, marked with black stripes on a yellowish-brown skin; thence called striped squirrel; also ground squirrel,



rel, since it lives in the ground, in which it burrows and makes its nest. It lives on seeds and nuts, which it carries in cheek pouches and stores up in its holes. It is also called cheeping squirrel, from the noise it makes. Its worst enemy is the weasel, which follows it into its burrow.

Chlo'ral. [Gk.] A chemical substance prepared by acting on pure alcohol with dry chlorine gas. It is a limpid, colorless liquid. With water it forms *chloral hydrate*, a crystalline substance, largely used for the purpose of obtaining quiet sleep.

Chlo'rides. [Gk.] Salts formed when chlorine gas unites with metals. The only chloride which occurs plentifully in nature is sea, or rock-salt, which is a chloride of sodium.

Chlo'rine. [Gk. *chloros*, light green.] One of the non-metallic elements, discovered by Scheele in 1774. It is prepared from common salt by the action of sulphuric acid on manganese dioxide. It is a transparent gas of a greenish-yellow color, which does not occur free in nature. United with the metals sodium, potassium, and magnesium, it forms the chief salts of sea-water. Chlorine is a powerful bleaching agent, and this action depends upon the power which it possesses of combining with the hydrogen of water, and so setting free the oxygen.

Chlo'roform. [Gk. *chloros*, light-green, and *formyl*.] A heavy; colorless volatile liquid, possessing an agreeable odor, like ether; it has a sweet though acid taste; it is only slightly soluble in water; it dissolves sulphur, phosphorus, gutta-percha, iodine, and fatty and resinous substances. It was discovered in 1831 by Guthrie in America, and attention was first called to its anæsthetic properties by Flourens in 1847, regarding its

effects on animals; and soon after this Simpson of Edinburgh introduced it as an anæsthetic in medical practice. Its effect on the nervous system is to cause a suspension of voluntary motion and of sensation, while respiration and the action of the heart are continued.

Chlo'rophyll. [Gk. *chloros*, light-green; *phyllon*, leaf.] The substance which gives plants their green color. It is a resinous substance, whose chemical composition is not exactly known.

Choc'olate. [Span. or Aztec.] A sweetmeat made from cocoa. (See *Cocoa*.)

Chol'era. An epidemic intestinal disease, which seems native to Southern Asia, and has at various times swept with terrible destruction of life over Europe and America. It produces severe and painful cramp, often quickly followed by death. It is now known to be due to a form of bacteria (*q. v.*), and recent epidemics have been checked by sanitary measures.

Chough. [AS.] A bird of the Crow family, of a black color, and with a long, slender, curved bill and red legs. The Cornish chough is the sea-swallow.

Chrome or Chro'mium. [Gk.] A hard, fusible, and brittle metal. Potassium chromate and lead chromate (chrome red) are used in dyeing and calico-printing. Chrome yellow is used by painters. Pure chromium is the most difficult to fuse of all the metals. Its compounds are much used in the arts, in painting and coloring. It forms four compounds with oxygen, and its chief ore is chrome ironstone, found in America, Sweden, and the Shetlands.

Chronom'eter. [Gk. *chronos*, time; and *metron*, a measure.] An instrument for the exact measurement of time. The name is commonly applied to a portable time-keeper, in opposition to a clock, which is stationary. In chronometers the balance-wheel is compensated, so as not to be affected by changes of temperature.



CHRYSA LIS.

Chrys'alis. [Gk. *chrysos*, gold.] The pupa or yellow form which many insects take before they get their wings. When the larva of the butterfly leaves off eating, it enters the chrysalis state. Wrapped in a dry skin, and hanging head downward, suspended or tied by a silken thread, it remains seemingly dead. A marvellous change is going on, and when

the skin bursts a fullgrown butterfly appears.

Chry'santhemum. [Gk. *chrysos*, gold; *anthemon*, flower.] A family of perennial plants, consisting of the ox-eye daisy, feverfew, but chiefly the garden chrysanthemum, of which there are 1,500 varieties, some of them of great size and beauty. Some have their petals rolled up like quills. This flower was introduced from China or Japan about 1764.

Ci'der. [Fr.] A drink made from the juice of apples. Besides being used as a beverage, it is used for making vinegar and cider-brandy.

Cigar'. [Span.] A small roll of dried tobacco leaves for smoking. Originally a kind of tobacco made in Havana, Cuba, where the finest are made. In the United States very many million cigars are made annually, and large numbers are also made in Havana.

Cigarette'. [Fr.] A roll of loose fine tobacco rolled in paper for smoking.

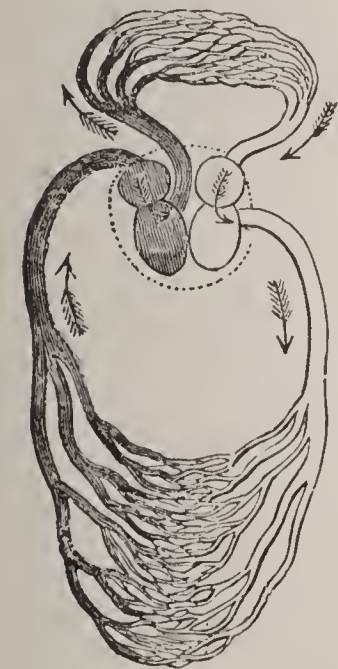
Cincho'na or **Cascaril'la**. A tree growing in the Andes and in the East Indies, from the bark of which is procured Peruvian bark, which yields quinine, a substance of great medicinal value in fevers. In the 17th century the wife of Count Cinchon, Viceroy of Peru, was cured of fever by the bark of this tree, hence the name.

Cin'nabar. [L. *cinnabaris*.] Red sulphide of mercury, or vermilion. It occurs as crystals. It is used as a paint and in medicine. *Cinnabar grecorum* is a red resin used for coloring varnishes, and known as dragon's blood.

Cin'namon. [Heb. *qinnamon*.] The bark of a kind of laurel tree found in Ceylon. It is aromatic, pungent, and used as a cordial. With cassia it yields the oil of cinnamon. Cinnamon is used in medicine, cooking, and confectionery.

Cir'cle [L. *circus*.] A plane figure contained by one line called the circumference, and such that all straight lines drawn from a point within the figure, called the centre, to the circumference are equal. Any straight line drawn through the centre of a circle, and terminated both ways by the circumference, is called a *diameter*. A line from the centre to the circumference is called a *radius*. Two diameters at right angles to one another divide a circle into four equal parts called quadrants. Each of these is divided into 90° , so that the whole circumference of a circle contains 360° .

Circula'tion. [L.] The movement of the blood through the vascular organs of animals. In birds and mammals, the air-breathing animals, the circulation is double (pulmonary and systemic), and is carried on through the heart (*q.v.*), the arteries, and the capillary tubes. In reptiles the heart consists of two auricles, and one ventricle, and there is an incomplete double circulation. In fishes, which are water-breathing animals, there is a simple circulation—the heart consisting of a single auricle and a single ventricle, the blood taking in oxygen and giving



out carbonic acid in the gills instead of the lungs, which are absent in fishes.

Cis'terns. [L. *cisterna*; from *cista*, box, chest.] Receptacles for water. They are generally square or round in shape, and are commonly lined with lead. Soft water acts upon lead, dissolving it and forming carbonate of lead,

which is a poisonous substance. It is the bright, clean lead which is affected. After the lead has become dull, or crusted over, the water can no longer dissolve it.

Cit'ric Acid. An acid which is found in lemon juice, and which also occurs along with tartaric and malic acids in many other fruits—such as oranges, cherries, currants, garden rhubarb, etc. It is prepared from lemon or lime juice. It crystallizes in large colorless crystals, which dissolve freely in water. When dissolved in syrup it is kept for use in the manufacture of lemonade. It is used by calico-printers, and in the dyeing of silk.

Cit'ron. A fruit of the same family as the lemon and orange, and of the shape of a lemon, but larger and rougher, while its juice is not so sour. It is a native of the south of Europe and Asia. A favorite confection is made of its peel preserved in sugar, and oil of citron is made from the peel and the leaves. Citric acid is sometimes made from its juice.

Clam. A bivalve shell-fish found in many seas, one species being the common edible clam abundant in the United States, and much used



as food. There are many varieties—as long clam, round clam, sea clam, little-neck clam, and giant

clam. The long clam burrows in the sand with the muscular organ usually known as its foot. Its shell grows at the hinge, and increases as fast as the animal grows. The giant clam is an inhabitant of the China Sea and South Pacific, and is the largest known bivalve mollusc, the shells being known to measure 2 feet in length and weigh 500 lbs.

Clar'et. [Fr., from L. *clarus*, clear.] A wine of a red color; first applied to Medoc wines, and then to red Bordeaux wines.

Clar'inet or **Clar'ionet**. [Fr.] A wind instrument blown by a single reed, and usually a leading instrument in a military band.

Clarion. [Fr.] A trumpet with a loud, clear sound.

Claw. [AS.] The toe nail of a beast or bird. The claw of the lion may be unsheathed or put out, and withdrawn or sheathed. The claws of the dog, which catches its prey with its teeth, are blunt, and cannot be withdrawn. The hawk and the eagle, that seize their prey alive, have all their toes or claws long, curved, strong, and sharp; but the vultures, that feed on dead animals, have short hind toes, nearly flat front ones, and all very weak. The bustard has no hind toe. Each foot of the spider has three claws: the middle one is bent over for clinging to the web; the other two have teeth like a comb, and are used sometimes for cleansing the limbs and webs.

Clay. [AS.] A fine-grained, sandy substance, derived from the decay of aluminium silicates. It is white when pure, but it is generally mixed with impurities which impart to it various shades

of gray, brown, red, purple, or blue. When dry it is friable, and when wet can be kneaded between the fingers. When shaken with water it becomes mud. It is largely used for making bricks and earthenware.

Clem'atis. A climbing plant of many kinds, found in most temperate regions, with beautiful flowers, having feathery styles that enlarge in the fruit.

Clock. [Celt.] A machine for measuring time, with wheels moved by weights or springs. It is usually made so as to tell the hour by the stroke of a hammer on a bell. An *alarm clock* has a mechanism to ring a gong at a set time. An *astronomical clock* has a compensating pendulum. An *electric clock* is regulated or moved by electricity. A *sidereal clock* keeps sidereal time, and is fitted on large telescopes.

Clouds. When vapor is condensed high up in the air, it receives the name of cloud. The three fundamental forms are—*cirrus*, *cumulus*, and *stratus*. The *cirrus* consists of fibrous, wispy, or feathery clouds, placed in the highest region of the atmosphere. *Cumulus* (heap cloud) consists of rounded masses commonly seen in the sky in summer, supposed to be formed by columns of ascending vapor, the upper portions of which have condensed. *Stratus* is a horizontal sheet, frequently formed at sunset, but which disappears again at sunrise. These primary forms combine into intermediate forms, and are all combined in the *nimbus* or storm-cloud, that from which rain falls. The average distance of clouds from the earth is between one and two miles, but streaky, curling clouds are often six or more miles high.

Clo'ver. A leguminous plant grown for fodder. It is one of the most useful crops a farmer can grow. Its roots collect and store up a large amount of plant-food. The common broad or red clover is the kind most generally grown. The white or Dutch clover grows in good pasture land; each stem bears a single head of flowers. Sheep are very fond of it. Crimson clover gives



CLOVES,

one excellent hay crop. Swedish clover, on the contrary, will grow strongly for two or three years in succession, yielding a very fair crop each year. It has a pink flower, and bears cold and wet well.

Cloves. [Fr.] The clove tree is of the Myrtle order,

and is a native of the Spice Islands, but is now cultivated in Zanzibar and the West Indies and other tropical countries. It resembles the laurel, and grows to a height of from 15 to 40 feet. Its leaves are large and oblong, its flowers small and dark red, and its fruit is like an olive in shape, but red like the flowers. The fruit, when dried, is known as "mother of cloves."

The cloves used for flavoring are the unopened flower-buds. These buds become dark-brown, and look like nails; and so they take their name from *clou*, the French word for nail. The little ball which seems to form the head of the nail is really composed of the petals of the flower, and will unroll if soaked in water. Cloves are used for their strong aromatic taste in flavoring food such as puddings, cakes, and preserves. *Oil of cloves* is useful in medicine, and to scent toilet soap.

Coach. [Fr., from Gk. *conche*, a shell.] A framework with cover and seats, set on wheels, for carrying people, having doors in the sides and an elevated seat for the driver. *Mail coaches* and *tally-ho coaches* often have four seats inside and seats for twelve outside.

Coal. [AS.] A black substance (consisting mainly of carbon), dug out of the earth, which burns and gives heat. Coal is of compact but



COAL UNDER THE MICROSCOPE.

brittle structure, and found in seams and beds, and is the remains of a luxuriant vegetation which flourished on the earth's surface during the Carboniferous age, and to some extent in other geological periods. It is supposed to be due to the action of heat and pressure upon great accumulations of this material. There are many varieties of coal, distinguished from one another by the varying proportions of the different constituents. *Bituminous coal*, such as is in general use, contains from 75 to 80 per cent. of carbon, 5 to 6 of hydrogen, and 10 to 12 of oxygen. *Anthracite* is the most completely mineralized variety, and contains about 90 per cent. of carbon, the gases oxygen and hydrogen having been driven off. *Cannel coal* and *lignite* contain less carbon and yield more ashes than those named. The present yearly output of coal in Great Britain and the United States is about 200,000,000 tons in each. Other countries yield much less. Some of the mines are very deep.

Coal-tar. A thick black liquid, obtained during the distillation of coal for the manufacture of illuminating gas. This substance yields madder, a coloring substance formerly obtained from the roots of a plant. One ton of cannel coal when distilled leaves 12 gallons of coal-tar, from which are produced 1 lb. of benzene, 1½ lb. of carbolic acid, and a number of other substances used for dyeing purposes. From these substances there may be obtained 16 distinct yellow colors, 12 orange, 30 red, 15 blue, 7 green, 9 violet, besides a number of browns, and an indefinite number of blendings.

Coat. [Fr.] An outer garment for the upper part of the body, chiefly worn by men.—*Coat of arms* (translation of *colle d'armes*, small coat worn over armor), the heraldic bearings of any one.

Co'balt. [Ger. *kobalt*; from *kobold*, a goblin.] A reddish-white metal, very tenacious, and very difficult to fuse; occurs in small quantities in meteoric stones, and is usually found combined with arsenic and sulphur. It forms three com-



COPRA DE CAPELLO.

pounds with oxygen. One oxide imparts a deep-blue color to glass. This glass, reduced to powder, is used in producing the blue colors in porcelain, pottery, glass, encaustic tiles, etc. Chloride of cobalt diluted forms sympathetic ink.

Co'bra de Ca-pel'lo. [Port.] The hooded snake, a very venomous ser-

pent found in India. Its hood is formed by the skin of its neck, which it can draw over its head. Ordinarily it is like other snakes, but when going to strike the head broadens out. It is usually carried about by snake-charmers; but in India many people die from its bite every year.

Coch'ineal. [Span.] A dye got from the dried bodies of insects found on a cactus in Mexico, Central America, etc., and yielding carmine red.

Cock. The male of a hen, particularly of domestic fowls; also a valve for drawing liquids; and a small pile of hay. *Weathercock* is a vane in the shape of a cock.

Cockatoo'. [Malay.] A bird of the Parrot family, having a short, strong, and much-curved beak and crested head. Among the many varieties are the sulphur-crested, broad-crested, and the great black cockatoo of Australia.

Cock'chafer. A beetle; called also may-bug or dor-beetle. (See *Beetle*.)

Coc'kle. [Celt.] A kind of shell-fish, a bivalve with radiating ribs, used in Europe as food; also a weed among corn—applied to the corn-rose and darnel.

Cock'roach. An insect of the straight winged family, of which there are many species, some living in the woods under stones, leaves and rotten logs; others, infesting houses, where they eat both animal and vegetable food, swarming out of their holes at night. There are two kinds common in houses, one small, and one quite large. They may be destroyed by poison or driven away by borax, which they do not like.

Co'coa. The product of the fruit of chocolate tree, a native of Mexico, Central America and Brazil. It is a handsome tree, 10 to 20 feet high, and is sheltered when growing by larger trees. It commences to bear fruit in the third year. The fruit is cucumber-shaped, and consists of a hard outer

part from 6 to 8 inches long, and a soft white pulp, which protects numerous seeds almost as large as almonds. The seeds are cleaned,

dried, and ground by hot rollers to a paste or powder, which is known as rock or flake cocoa. Sometimes they are broken up by rollers into pieces, which are called cocoa nibs. Mixed with sugar and spices, flake cocoa is known as chocolate, and is used in cakes and sweetmeats. About one-half of the weight of the seeds is due to a fat called cocoa butter; much of this is removed in making chocolate. The active principle of cocoa is theobromine, a nitrogenous product.



COCOA.

Co'coa-nut. The nut of the cocoa-palm. The tree grows in tropical countries to a height of from 60 to 80 feet, and is without branches, the leaves

and clusters of nuts being at the top. The nut has a milky fluid, and a white meat of albumen which yields an oil. The cocoa-palm is found in all parts of the tropics, and is a very useful food-plant, while its nuts are used in large quantities in temperate regions for confectionery and other purposes. (See *Palm*.)

Cocoon'. [Fr.] The case spun by insects to cover them, especially the oblong case of the silk-worm in its chrysalis state, which is formed of threads of silk spun by the insect in its larval state, and from which the silk of commerce is prepared.

Cod. [Goth.] An important sea-fish, used as food, and taken in immense quantities on the northern coasts of Europe and North America.



COFFEE-PLANT

It is very abundant and large on the Banks of Newfoundland. There are several kinds—shore-cod, in shallow water; rock-cod, often mottled. Cod-liver oil is obtained from the liver of the cod-fish, and is used extensively in medicine to supply the body with fat.

Cof'fee. The fruit of a tropical evergreen tree from whose beans is prepared a favorite beverage. In its wild state the coffee tree grows from 20 to 30 feet high, but when cultivated is not allowed to grow more than 8 or 10 feet. Its flowers are small, white, and fragrant-smelling, and grow in thick clusters. Its berry or fruit is like a cherry, and contains two seeds or beans. The first crop of fruit appears when the trees are three years old. The plants bear fruit for many months, so that several crops can be gathered in a year. The berries are dried; then the beans are removed by rollers from the pulp that surrounds them. Coffee thrives in moist, warm countries, as Abyssinia, Arabia, Brazil, Ceylon, Java, and the West Indies. To *make* coffee, the beans are roasted and then ground to a fine powder. Boiling water is then poured on the ground coffee; this dissolves a substance called *cafein*. The best coffee is the *Mocha*, grown in Arabia. *Java* coffee is also of fine quality. There are many other varieties, differing greatly in flavor. Coffee is used very largely in the United States.

Cog. [Celt.] A tooth or cam on the rim of a gear-wheel for imparting or receiving motion. A cog-wheel is a gear-wheel with cogs or teeth.

Co'gnac. A kind of French brandy, so named from the town Cognac.

Coin. [Fr., from L. *cuneus*, a wedge.] A piece of metal stamped to be used for money. It is round, flat, bright, hard, and durable. Alloys of the metals are generally used. They are melted into ingots, rolled into ribbons to the required thickness, and punched, rounded, milled, and stamped with a die and counter-die, and weighed.

Coke. [O.E.] Mineral coal from which bitumen, sulphur, or gas has been extracted by roasting in a kiln or oven, or by distillation, as for gas. It is smokeless, and is largely used in steel works and in foundries.

Cold Storage. A method of preserving food substances by keeping them in a low temperature. Freezing machines are used to chill the air for this purpose. This system has come widely into use, cold storage rooms being provided in all our large cities in which vegetables, fruits, and meats can be kept for any desired length of time. They are of much use in markets to preserve the material left unsold. Cold storage meats need to be used soon after being thawed out, as they spoil more quickly than unfrozen meats.

Cold Wave. The name given in the United States to spells of severe depression in temperature, usually the effect of anti-cyclonic conditions arising in the great plains of western Canada.

Col'lie. A Scotch shepherd dog remarkable for its intelligence. There are two breeds, rough-haired and smooth-haired.

Collo'dion. [Gk. *kolla*, glue; and *eidos*, like.] A substance formed when gun-cotton is dissolved in a mixture of alcohol and ether. It is used in photography for the purpose of forming a thin film on the glass which is to receive the silver salts on which the image is formed. Combined with camphor it forms celluloid (*q.v.*)

Cologne' or Cologne Water. A perfume made of alcohol flavored with essential oils. The oils of many flowers are used, though much of the cologne sold is a cheap imitation of the real article. It was named from the city of Cologne, where it was first made.

Co'lon. [Gk.] The mark (:) used at the end of a clause complete in itself and nearly independent. *Semicolon*, the mark (;) used to indicate a separation more distinct than the comma.

Col'o'r. [L.] The term used to express the different sensations which are produced when light of different kinds enter the eye. When ordinary white light is passed through a prism (*q.v.*), it is decomposed into seven colored rays—violet, indigo, blue, green, yellow, orange, red. There are three primary color sensations—red, green, and violet; and the blending of these in different proportions gives rise to all the other colors.

Col'umn. [L.] A long round piece of stone, wood, or metal set on end to hold up or adorn a building. It is usually ornamented, and composed of base, shaft, and capital. A clustered column is a column composed of several smaller columns. (See *Capital*.)

Com'ets. [Gk. *kome*, hair.] A wandering class of heavenly bodies. As seen through a powerful telescope, a comet consists of an ill-defined mass of light called the head, which is much brighter towards the centre, presenting the appearance of a *nucleus* like a star or planet. Surrounding the nucleus there are certain definite layers of luminous material, which seems to unite behind the head, and from which a luminous train called the tail proceeds. The direction in which the tail points is always opposite to that of the sun. There are many comets revolving round the sun in very elliptic orbits, almost touching the sun at one end of the orbit and very distant at the other. Other comets are supposed to come from the depths of space. Some of them break up into fragments and form meteoric rings.

Com'mon. [Fr.] A piece of land to which all have right for pleasure or pasturage.

Com'pass, Mar'iners. A magnet (*q.v.*), when suspended horizontally, always points in a direction nearly north and south, and on this principle has been constructed the mariner's compass, an instrument of great value to sailors, as showing them in what direction to steer. In the compass the needle is fitted up in such



a way that it will always remain horizontal whether the ship is pitching or rolling. The needle is firmly attached to a circular card (called the compass card), which is divided into thirty-two equal parts by lines drawn from the centre to

the circumference. The mariner's compass was brought from China to Europe during the thirteenth century.

Compress'ed Air. One of the first important uses of compressed air as a source of power was in the excavation of the Mount Cenis and the Hoosac Mountain railroad tunnels, in which air compressed by water power was conducted by pipes into the depth of the tunnels. Another important use is in the air brake on railroad trains. It is used for many other purposes, an important one being the propulsion of street cars by compressed air motor engines, and another one the driving of letters through tubes from the central to the branch offices of some large cities.

Concerti'na. [Ital.] A small musical instrument like an accordion, with bellows, having reeds inside and keys and handles on each of two six-sided heads.

Con'crete. [L.] A hard building material made of gravel, pebbles, sand, and pieces of stone held together by cement (*q. v.*), or tar, used for sidewalks, foundations, and submarine structures.

Con'dor. [Span.] The largest of known vultures. It is of the vulture kind, and lives on the highest Andes, building its nest 15,000 feet above the level of the sea. In winter these birds descend in groups to feed on the low grounds and the seashore. They possess the instinct of discovering a dead or dying animal at a very great distance, and though they feed principally on carrion they will sometimes seize living animals. The condor is usually 4 feet long, and has 9 feet spread of wing.

Cone. [Fr.] A figure with a round base tapering to the top or vertex. Also the fruit of firs, cedars, and other trees known as conifers, composed of woody scales, each of which has one or two seeds at its base.

Congou. [Chin.] Black tea of higher grade, finer leaf, and less dusty than bohea. It means "well worked." In the United States it is called "English breakfast tea."

Constella'tion. [L. *con* ; and *stella*, a star.] The name given to the artificial groups of stars. The figures of men and animals were of old supposed to be outlined in the sky, and mythological names were given to them. The stars in a constellation are distinguished by the Greek letters *a, b, g, d*, etc. ; as *a Tauri* (*Alderbaran*), first star in Taurus, or *g Orionis* (*Bellatrix*), third star in Orion.

Convolv'ulus. [L.] A monopetalous plant with twining stems, including the bindweed, with flowers beautifully colored. Morning glory, and sweet potato belong to the same family, and are first cousins to convolvulus.

Co'ny. [O.E.] A kind of rabbit. The cony of Scripture is the daman or rock-rabbit.

Coot. [Du.] A short-tailed water bird. It is the common mud-hen of the marshes, and is interesting because of its lobed foot, which has flaps on the sides of the toes. The European coot is named the bald coot, in allusion to the bald or bare patch on the front of its head. There are several American varieties.

Co'pal. [Span.] A resinous substance consisting of the dried juice of various trees growing in Zanzibar, Madagascar, India, and South America. In Africa also it is dug from the earth where forests once stood. It is sold in rounded masses, and in appearance resembles amber. After being melted, it becomes soluble in alcohol ; and in this way varnishes and lacquers are prepared.

Cop'per. [O.E.] A metal, so called from the island of Cyprus, where the Greeks and Romans obtained it. Metallic copper is found in the United States, but it is generally prepared from its ores, of which there are several, found in most European countries, as well as in North and South America, Africa, Australia, and Japan. The principal localities in the United States are Michigan, Montana, and Arizona. It can be ob-

tained from its ores at a comparatively low temperature ; which accounts for its extensive use in the early stages of civilization. Metallic copper possesses a deep, red color, takes on a brilliant polish, is very malleable and ductile, and as a conductor of heat and electricity it comes next to silver. It is not acted on by water, nor by exposure to dry air, but in moist air it becomes coated with green carbonate. Red oxide of copper is used for coloring glass. Blue vitriol is the sulphate, and is much used in dyeing



CORAL.

and in the preparation of paints. Copper mixed with tin is bell-metal, and with less tin is bronze ; with zinc, it is brass or pinchbeck.

Cop'per=plate. A plate of copper on which pictures or writing are engraved. In printing from copper the lines are filled with ink, the surface is wiped clean, and the impression taken by pressing paper under the roller of a press.

Cor'al. [Animal.] A minute creature, of low organization, which builds itself a framework of carbonate of lime, which is lined with the fleshy body of the living animal. Corals live in colonies in the warm seas, and their combined shells form

great masses of coral rock, which in some regions become reefs or islands. They cannot exist at a depth greater than from 90 to 120 feet, and they also die by exposure to the air, so that from a depth of about 100 feet they work upwards until they reach low-water mark; and when their progress is thus stopped in the upward direction, they begin to grow outwards, increasing on the outer edges of the reef, where they find food, carried by the ocean currents, most abundant. The action of the waves and the chemical action of the sea-water cement the materials into a firm steep slope. When a reef has been built on a shelving sea-bottom near a continent or round a volcanic island, the space of water inside is called the *lagoon channel*. When the reef has been built on a submarine ridge or peak, it forms a circular island, called an *atoll*, with a broad lake of sea-water inside, called a *lagoon*.

Corduroy. [Fr.] A thick cotton cloth with the surface in ridges.

Cork. [Span.] The bark of a tree similar to the oak in appearance. The trees grow for 15 years before the cork is gathered, and some trees live over 150 years. They are found in Spain, Italy, and Portugal. The cork forests of Spain cover 620,000 acres. The bark is cut lengthwise, and stripped off in sheets in July and August. After a year new bark forms, and the process is repeated every three or four years. The sheets are soaked in water and placed under weights, and when dry are ready for use. These sheets are cut into corks by machinery. They are first cut into narrow strips, then they are cut into different-sized pieces for bottles, and then rounded. Cork is used for stoppers because it is elastic, so that after being pressed into the neck of a bottle it fills the space and allows no air to pass in nor any of the contents to escape. Cork is also used for soles of slippers and in the making of life-boats and life-preservers.

Cor'morant. [Fr., from *L. corvus marinus*, or sea-crow.] A sea-bird which greedily devours fish. It is about the size of a goose, and has a



yellowish skin, which, hanging loosely under its bill, forms a wide pouch. The legs are strong and black, and the webbed feet have one claw,

indented like a saw. The cormorant is wont to fish with its head under water, and it has such a clear eye and dives so well that it is able to be under the waves till it catches its fish. Fish after fish will disappear into the skinny pouch under the bill. It is said a cormorant can devour 4 lbs. of fish a day, which is half its own weight. If a fish is too large to swallow, it will toss it up in the air, and catching it again head foremost bolt it more easily. In China, the cormorant is trained to dive and catch fish, but a strap beneath

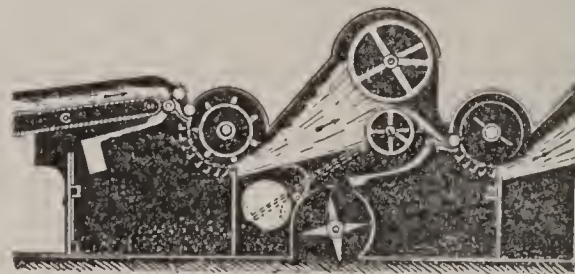
its throat prevents it from swallowing it; each time the fish is taken from it, the bird returns to its work till the owner is satisfied.

Corn. [AS.] In Scotland, applied to oats; in the United States, to maize; in England, to wheat; in Russia, to rye and barley. A collective name for the grains. The corn-producing grasses furnish excellent food for both man and beast. They contain a great deal of starch, and also a fair proportion of such flesh-formers as gluten and fibrin. Wheat and oats are superior as food to barley and rye, containing more flesh-forming matter and less water. Wheat is, as a rule, too expensive a food to give to cattle, but the bran, which consists of the outer coating of the grain of wheat, is a very useful food for cattle and horses. It is rather indigestible, and should first be scalded in boiling water. Oats and maize are largely used for animal food.

Cor'net. [Fr.] A wind instrument made of brass, furnished with valves moved by small pistons or sliding rods, and used in bands and orchestras.

Corolla. [L.] The colored envelope of a flower which surrounds the organs of fructification, consisting of one or more leaves called petals.

Cot'ton. [Fr.] The cotton plant is an annual, and belongs to the same order as the marsh-mallow and the hollyhock. Originally it was a native of Asia, but it is now cultivated in almost all warm countries, especially in the southern



INSIDE OF PICKER

portions of the United States, India, China, Egypt, Brazil, and the West Indies. The plant grows to various heights in different coun-

tries, varying from 2 or 6 feet to 9 or 10 feet. Its leaves are dark green, and its flowers are large and usually white or bright yellow. As each flower drops a seed-pod takes its place. These pods are three-sided, and about the size of a walnut. When ripe these pods burst open, showing within a mass of white fibres, which are the snowy balls of cotton. The pods are gathered and the cotton taken out and dried. The seeds are removed by the cotton-gin, a machine with revolving cylinders, covered with sharp teeth, which tear the seeds from the cotton. The cotton is then pressed into large bales. In making cotton cloth, the cotton is thoroughly cleaned by a cotton-picker, carded, and spun into long, fine threads for the warp or for cross-threads. The spinning-wheel formerly did this, one thread at a time. Hargreaves invented "the jenny," by which eight threads could be produced at the same time. Continued improvements have made the machinery so perfect as to render the process of spinning easy and rapid. Sewing cotton is made by twisting together several of the fine fibres, and winding on reels or bobbins. The weaving of cotton consists in crossing and re-crossing the threads in a loom to form cloth.

The threads which extend the length of the cloth form the warp; the threads crossing from side to side form the woof or weft. The fabrics made from cotton include gingham (where the yarn is dyed before being woven), cambric, muslin, lawn, calico, chintz (a kind of heavy calico, gaily colored), corduroy, velveteen, wincey, and other stuffs mixed with silk or wool.

Cotton-Seed Oil. The seeds of the cotton plant, which are left in large quantities after the extraction of the cotton fibre, have become valuable as a source of oil, which, when clarified, is of a clear golden-yellow color. It is used as an adulterant or a substitute for linseed, sperm, lard, olive, and almond oil, for cooking in place of lard or butter, and for other purposes. A large proportion of the salad oil used in the United States is Cotton-Seed oil. The "cake," which is left after the oil is pressed from the seeds, is used as a fodder for cattle and as a fertilizer.

Cow. [O.E.] A hoofed, herbivorous animal, which is one of the most useful of all animals to man. It is somewhat smaller than the horse, has long, smooth horns, large, gentle eyes, and a tufted tail.



THE CRANE.

Its hoofs are cloven. Like the horse, it is a grass-eater; and, like the sheep, it chews the cud. (See *Digestion*.) We seldom take a meal but some of the food we eat or drink is supplied by this useful animal. It gives a large quantity of milk, which is used either as it comes from the cow, in cooking, or made into butter and cheese. Its flesh is called beef (*q.v.*); its fat is made into tallow, from which candles and soap are made; its skin is tanned and made into boots, shoes, harness, and other leather articles; its hair is mixed with plaster; its hoofs are made into glue; its horns are made into combs, spoons, buttons, and the handles of knives and forks; and in some countries in Europe, Asia, Africa, and Australia, oxen are used as beasts of burden or to draw the plough. There are many different breeds, some of which are useful for dairy purposes, others yield good beef.

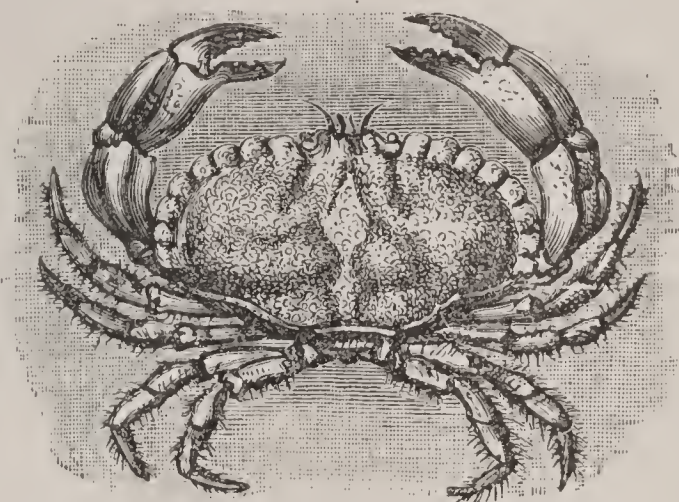
Cou'gar. A large American animal of the cat family, resembling the panther but smaller. It is often called panther (or painter). It is also called the puma, and formerly was known as the catamount, or mountain cat. It crouches in trees in the forests and springs on passing deer. In South America it kills and feeds on wild cattle.

Cow'ry. [Hind.] A small sea-shell, somewhat like a coffee berry and used as money in Siam and Africa. The shell is produced by the mollusc, and the spots on its surface are made by a coloring matter secreted by the mantle.

Cow'slip. [AS.] A kind of primrose with several flowers on one stalk appearing early in the spring.

Cow-tree. [Span.] An evergreen tree found in Venezuela, first discovered by Humboldt. The sap flows freely when the bark is wounded; and it is safe to drink freely, for the fluid, which has the color and taste of milk, is not only cool but refreshing and nutritious. It is, however, acrid and bitter. Also called the traveller's tree.

Crab. [AS.] A shell-fish with strong claws, and a tail tucked underneath its body. The eyes of crabs are on long stalks, and may be turned about or folded back into little grooves in the shell. Crabs breathe by gills, and a crab's heart consists of a single sac. They shed their shells



at intervals, and while the new shell is growing is known as *soft-shell crabs*. These are esteemed as food in the United States. In the tropics some species of crabs live in the fresh water of the rivers; others in the damp forests, visiting the sea-shore to deposit their eggs; others, like the land-crabs of Jamaica, live on the mountain tops. The hermit crab is a curious animal without a shell for its soft body; so it seeks to shelter its body in some empty shell, and when it outgrows one shell hunts for a larger one, sometimes turning out the living owner of a shell it wishes. The fiddler crab has one claw much larger than the other, developed by fighting, which it holds up as it walks sideways. The females of the pea crabs, or oyster crabs, live in oyster shells, and go out and in at will. Horse-shoe crabs, or king crabs, the largest crabs, are dark brown, and have long, stiff tails.

Cran'berry. [AS.] A red berry with a sour taste, growing on a stalk like the neck of a crane. It is cultivated in Europe and the United States, the American plant bearing larger berries. It is used in tarts, and is cooked with sugar as a dessert.

Crane. [AS.] A long-legged, long necked wading-bird. Cranes are either white or brown, and are without crest plumes on their heads, except the African crowned crane, which has an upright tuft on its head. They are remarkable for their long migrations twice every year, and for their perfect

discipline on these journeys. The Greeks and Romans esteemed the flesh of the crane as a delicacy.

Crane. A machine for lifting and lowering weights, and, while holding them suspended, carrying them a short distance to the side.

Crank. [O.E.] A bent portion of an axle or shaft or an arm keyed at right angles to the end of a shaft, by which motion is directed or received.

Cray'on. [Fr.] A pencil of colored chalk. A pencil of carbon used in producing electric light.

Cream. [Fr.] Cream is milk-fat, and rises above the watery particles of the milk. When cream is examined with a microscope, it is seen to be composed of very small balls of fat, each of which has a skin or covering of curd. By churning, the skin of curd is broken, and the little lumps of fat unite to form the yellow solid called *butter*. (See *Curds*)—*Cold-cream*, an ointment of white wax, almond oil, rose-water, and borax, used as a salve.

Cream of Tartar. An alkaline tartrate, known as the bitartrate of potash. As prepared from argol—a deposit from grape-juice—it is a white crystalline substance, and the crystals, when reduced to powder, form the *cream* of tartar. It dissolves readily in hot water, but sparingly in cold. It is used in medicine.

Cre'matory. Within recent times burning instead of burying dead bodies has come into use to some extent, and is growing in popularity. Crematories or furnaces for this purpose exist in several of our large cities.

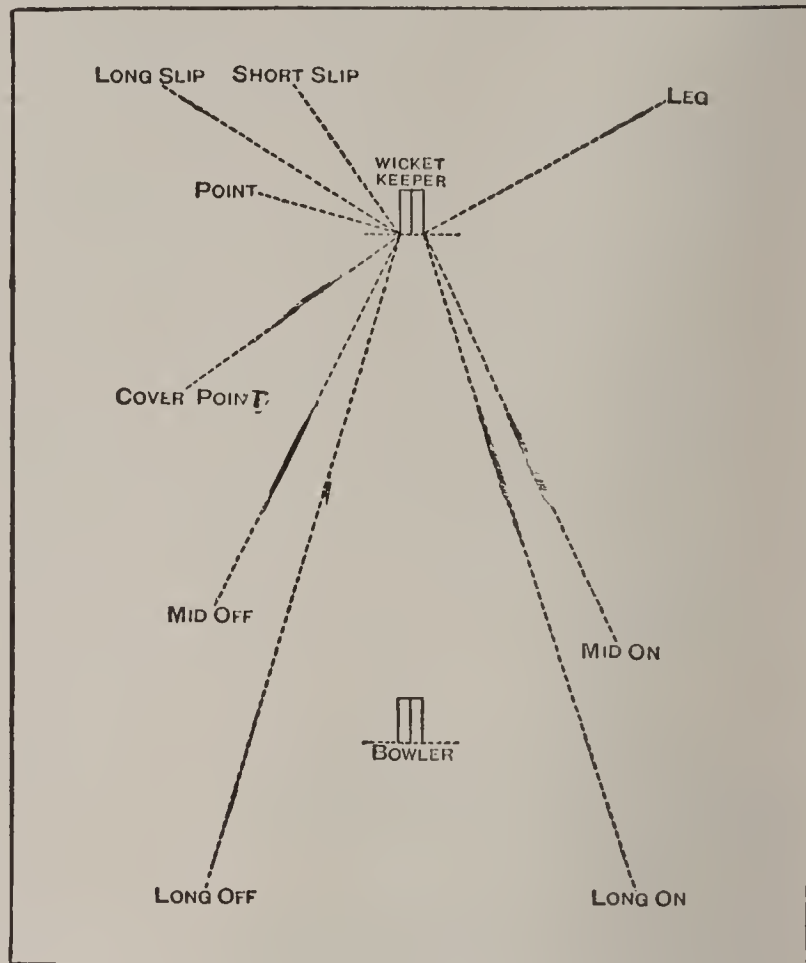
Cream'ery. A factory for the production of butter. Creameries are now widely in use in the United States, their effect being cheapness in production and a better and more uniform quality of butter than that made on the farm.

Cre'osote. One of the substances derived from the tar obtained from the distillation of wood. It differs chemically from the creosote obtained by distilling coal-tar. Wood creosote coagulates albumen, but does not coagulate collodion; which distinguishes it from carbolic acid, the leading product of coal creosote. It has great antiseptic power, hence its name (Gk. *kreas*, flesh; and *sozein*, to preserve). A piece of meat steeped in it does not putrify. Both wood and coal-tar creosote are used as preservatives for timber placed in the ground.

Cress. [AS.] A plant which grows in moist places, used as a salad. The leaves have a pungent taste, and are anti-scorbutic.

Crick'et. [Fr.] An insect with a sharp voice found under the floors of houses in Europe. Whatever is moist they seek for, and they will eat yeast, crumbs, milk, or kitchen refuse. The noise of the cricket is produced by the male. He raises his horny wing-cases and rubs them briskly together. The sound he makes is *cree-cree*, hence his name. In Africa crickets are fed in a kind of iron oven and sold to the natives, who esteem them because their noise lulls to sleep. The field-cricket feeds on herbs that grow at the mouth of its burrows, and in summer they sit there chirping all night and day.

Cricket. [AS. *crook*, a small staff.] A game played with bat and ball and wickets. It is the favorite game in England, the British Colo-



nies. In the colleges and cities of the Eastern States it has become popular. Eleven men make a team. The man with the bat stands in front of the wicket, which is three upright stakes with two short bails or sticks resting on their top, when these are knocked off the player is out. The ball is bowled with an over-hand throw with the purpose of knocking the wicket.

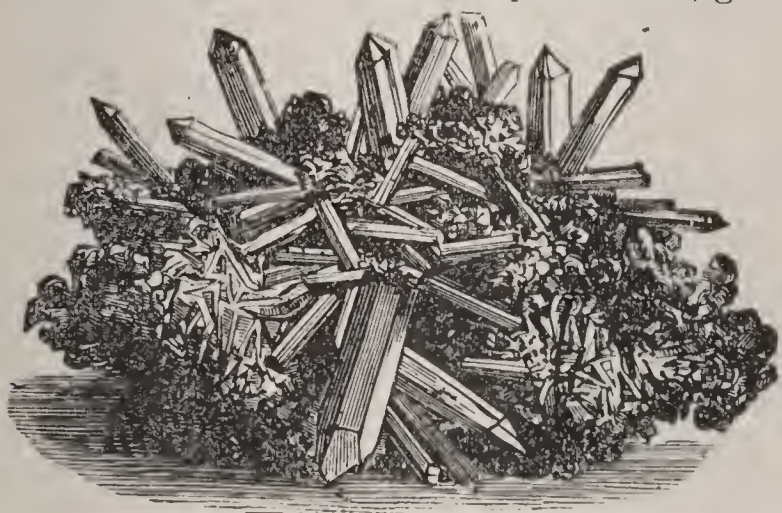
Cro'chet. [Fr.] Knitting by a hooked needle with cotton, worsted, or silk.

Croc'odile. [Gk.] A large and fierce animal found in the Nile and other rivers of Africa, also in Asia and America. It grows to 16 or 18 feet in length. The mouth of the crocodile has no lips to cover its strong teeth, which are firmly set in pits in the jaw, with a new tooth started below the root of each tooth. The fourth tooth in the lower jaw is longer than the other teeth, and when the mouth is closed it reaches up over the upper jaw. The crocodile bird enters its mouth in pursuit of insects which infest its mouth. The hide of the crocodile is tough, and is composed of plates of bone covered with horny scales. Its tail is useful in swimming, and also in the capture of its prey. It strikes large animals with it, and by it holds them under the water till they drown. Its neck is wanting in flexibility, and so it has much difficulty in turning. Its eggs are laid in the sand, and hatched by the heat of the sun. Alligators are like crocodiles, but they are smaller, and their feet are not so completely webbed, and they are found only in American waters.

Cro'cus. [L.] A flower white in color in wild state; cultivated forms are yellow or purple; rising from the bulb, blossoming early in spring. One species, the saffron, blossoms in autumn.

Cross. [Fr., from L.] Two pieces of wood laid one across the other, either simple cross I, or St. Andrew's Cross X, or St. Anthony's Cross T, or the Latin Cross †.

Crow. [AS.] A genus of birds, related to the magpies, nutcrackers, jays, and other forms. The Crows have long, strong, and compressed bills, with the ridge of the mandible more or less curved, and the tip notched; the wings are usually long, the tarsi covered with broad plates, and toes of moderate length. They feed not only on grain and fruit, but on animal substances, and some species on carrion. They all make large nests of sticks, lined with soft hair or down, and lay eggs with dark spots on pale-bluish, green-



CRYSTALS.

ish, or white ground. True crows include the raven, the carrion crow, the hooded crow, and the rook. The rook and jackdaw are gregarious, the rook nesting on trees, and the jackdaw on high buildings, such as church towers. The raven, carrion crow, and hooded crow all feed on carrion, and are fond of eggs, and young birds or rabbits. The American crow resembles the carrion crow, but is smaller, and after the breeding season gathers in large flocks. Its fondness for grain and seeds is an annoyance to the farmer, but it repays him by devouring large numbers of worms and larvæ. It is one of the most intelligent of birds. The fish crow of the United States is very expert in catching river and sea fish.

Crown. [Fr.] An ornamental head-dress for a king or queen. Nobles wear coronets, the pope a triple crown or tiara. The crown of England is a circle of gold with crosses, fleur-de-lis, and imperial arches, enclosing a velvet cap, and set in diamonds and precious stones.

Cru'cible. A vessel or pot for the melting of glass or metals. It is made of some substance which will stand a great heat, usually clay mixed with black-lead, sand, or other refractory substance. For the use of chemists crucibles are made of platinum, silver, porcelain, blacklead.

Cruiser. In modern navies a cruiser is a ship-of-war, armored or unarmored, designed for cruising, and lighter in armament than the battleship, while higher in speed. •

Crys'tals. [Gk.] The term applied in chemistry and mineralogy to those bodies which have assumed a regular geometrical form, in contradistinction to those substances which are amorphous. Although there are numerous varieties of crystalline form, they can all be reduced to six primary systems. These are distinguished from each other by the number and position of the *axes*, which are mathematical straight lines assumed to intersect each other in the centre of the crystal, and to connect the opposite faces of the crystal or its opposite corners. Each substance which crystallizes possesses a definite form, serving as one of the marks to distinguish it from other substances.

Cuck'oo. [O.E.] A climbing and perching bird, about twice the size of a lark, which feeds on caterpillars, grubs, and insects. The cuckoo does not build a nest, but places her eggs in the nests of other birds. Sometimes the birds turn the strange egg out, but oftener the mother bird takes it under her care and hatches it with her own. Though the cuckoo egg is small, the young cuckoo is larger than those young birds in the same nest, and turns all the other young birds out, and often kills them. The tree-cuckoos of America also have this peculiarity. The cuckoo is called "the harbinger of spring," because it comes over the sea when winter is gone, and its cry of "Cuckoo! cuckoo!" seems to say that spring is come. The Arabs think the bird says "Yakub!" hence they call it Yakub's (or Jacob's) bird.

Cu'cumber. [L.] A creeping plant, with fruit of a long and usually curved shape, used for salads, either fresh or pickled.

Curacoa'. A liqueur or cordial, flavored with orange-peel, cinnamon, and mace; first made at the island of Curaçoa, in the Dutch West Indies.

Curds. [Celt.] The thickened part of milk. If a weak acid be added to milk, solid whitish lumps of *curd* separate from a watery liquid called *whey*. If, instead of a weak acid, an acid fluid obtained by soaking the stomach of a young calf in salt water, which is called *rennet*, is used, it quickly and completely coagulates the curd and separates it from the whey. When curds are analyzed, they are found to be composed of a substance known as *casein*, which contains nitrogen, and is classed with the nitrogenous or flesh-forming food-stuffs.

Cur'lew. [Fr.] A sea-bird which neither swims nor dives, and leaves the shore in summer for the inland country, where it nests and rears its young. In the autumn and winter months flocks of curlews may be seen at the sea-shore feeding on small crabs, shrimps, and worms. The curlew is about two feet in length, and when its wings are spread out they measure three feet from tip to tip. It makes its nest on the ground among dry grass, and lays in it four greenish eggs spotted with brown. It is easily tamed, and is common in Europe, North America, and some parts of Asia.

Cur'rant. [Fr., from Gk. *korinthos*.] A small seedless raisin from Corinth; the fruit of several

shrubs, as common red-currant, white currant, and black currant, used for jams or jellies; also the flowering currant, with showy white, red, or yellow flowers.

Cur'rent, Electric. A quantity of electrical force conveyed along a wire, from an electric machine, a galvanic battery, or a dynamo, and employed for producing sparks, operating motors, etc.

Cut'lery. All kinds of table, hunting, butchers' and cooks' knives and forks; razors, pocket-knives, scissors, and shears. Also surgical, dissecting and dental instruments are sometimes included.

Cut'tle=fish. A form of mollusc, without an external shell, somewhat like the octopus, but with two tentacles longer than the arms and with club-shaped ends and curious suckers. There are also narrow fins at the sides of the body; and the mantle is supported on the inside by a thin plate, which is known as cuttle-fish bone.

These are used in bird-cages. They are not like true bone, but are formed of layers like shells, with a hard covering, and the birds peck small particles of lime from them.

Cy'clone. [Gk.] A great storm moving in a circle or spiral, which may be less than 100 or more than 2,000 miles in diameter. It is attended with violent winds and heavy rains, and sometimes does immense damage. The storm moves slowly or rapidly forward. The *Anti-cyclone* is opposite to the cyclone, its winds blowing out from instead of towards a centre.

Cyl'inder. [Gk.] A long, round body, the ends of which are equal circles opposite to each other.

Cym'bal. [Gk.] A musical instrument formed of two metal plates, which are clashed together.

Cy'press. [L.] An evergreen tree, often planted in grave-yards. Its wood is remarkable for great durability, and yields a healing balsam.

D

Dace. A small fish of the Carp family, found in clear and quiet streams in Europe. It makes good sport for the angler, and its flesh is preferred to that of the roach, but is not highly esteemed.

Da'do. [Ital. a cube.] The solid part of the pedestal of a statue; the lower part of the wall of a room when ornamented with mouldings or differently from the rest.

Daf'fodil. [Fr.] A kind of lily or narcissus, with a bulbous root and beautiful flowers, usually yellow; called *daffadowndilly*.

Daguerre'otype. The predecessor of the photograph; the method of printing pictures of natural objects discovered by Louis Daguerre, and made known in 1839. The images were impressed on a silver plate, made very sensitive to light by a coating of iodide and bromide of silver. The daguerreotypes were not very permanent, and have been replaced by photographs. (See *Photography*.)

Dah'lia. [Swed. *A. Dahl*, a botanist.] A tuberous plant, with a large and beautiful single or double flower. It is a native of Mexico and Central America; but the cultivated varieties are numerous—more than two thousand—with bright and varied colors. The first roots were carried to Europe by Humboldt in 1790.

Dai'ry. [Scand.] A place for keeping milk and making butter and cheese. A dairy should be lofty, well built, and roofed with slate, the windows covered with gauze wire, the floors and walls overlaid with smooth, polished tiles, and the shelves of slate or marble. It should be cool, dry, clean, and well ventilated, and furnished with pails, coolers, sieves, bowls (either of earthenware or glass), dishes for skimming milk, plunge or barrel churns for making butter, slices, scales, and weights. A system of dairy factories or associated dairies was instituted in the United States in 1860, and has developed so greatly that there are now more than 1000 in

the State of New York alone, and the system has been introduced into several countries of Europe. They were at first confined to cheese-making, but many of them now make butter and cheese, and there are numerous creameries (*q.v.*), making butter only.

Dai'sy. [AS., day's eye.] A small wild flower, with a white rim of petals arranged like a star, and a yellow centre. The flower is held in a green cup, on a short, wiry stalk rising from thick green leaves. It grows in fields or by the wayside, and is found low down in the grass. It blooms from early spring to late in autumn, opens when the sun shines and closes at night. *Ox-eye daisy*, or the Daisy of North America, is also called the whiteweed. It is a kind of *chrysanthemum*.

Dam'ask. [Damascus.] Cloth of silk, linen, or wool, with figures woven on it by different directions of thread without change of color, first made at Damascus. Damask is woven with a twill, in which the weft threads skip eight of the warp. In diaper cloth the weft skips five instead of eight.

Dancers, Eastern. Young women of the Eastern countries noted in the dance for their graceful and rhythmic movements.

Dan'delion. [L. *dens leonis*, a lion's tooth.] An herb common in Europe and the United States, with large yellow compound flowers, and leaves with jagged or notched edges. The root is mixed with coffee, and is a useful tonic, and the young leaves are used as a salad.

Darwin'ian Theory. The theory of *natural selection*, advanced in 1859 by Charles Darwin, which maintains that all species of animals and plants are derived from older species by a process of survival of the individuals best adapted to the surrounding conditions of nature, and hereditary transmission of their superior structure.

Date. [Fr.] The date palm-tree and its fruit. The fruit is shaped like an olive, is sweet and wholesome, and has a hard kernel. It is the

chief article of food of the natives of Arabia and North Africa, and is their principal source of wealth. The tree rises to a height of 60 feet, with a crown of large feathery leaves and flower-



EASTERN DANCERS.

stalks, and white flowers that are followed by the fruit in bunches. The leaves are used as thatch, the sap by fermentation is made into wine, and the wood is useful for furniture and in building.

Da'vit. [Fr.] A piece of timber used for keeping the anchor clear of the ship's side when being hoisted; *pl.*, arms of iron over a ship's side or stern from which a boat is hung, ready to be let down or to be raised.

Day. [AS.] A word originally used to indicate the period of time during which it was light, in contrast to night or the period of darkness. This usage still exists, but a day in its civil or legal sense, is now the period between midnight and the succeeding midnight, or 24 hours. The sidereal day, which is based on a seeming revolution of the stars, instead of the sun, is shorter, being 23 hrs. 56 min. 49 sec. Astronomers reckon the day as beginning at noon, and count the hours from 1 to 24.

Dea'con. A person in the lowest degree of holy orders. In the Roman Catholic Church the deacon acts as an assistant to the priest, and may preach and baptize with the permission of the bishop. In the Church of England he can exercise nearly all priestly functions. In the Presbyterian, Baptist and other Churches the deacon or elder is an officer selected to assist the minister in the direction of religious affairs.

Decant'er. [Fr.] A large glass or bottle for holding liquor free from sediment, from which drinking glasses are filled.

Deck. [Du.] The upper floor or covering of a ship. The name, however, in a large vessel is applied to the berth deck, where the sailors' hammocks are hung; the gun-deck; half-deck, the part below the spar-deck; hurricane-deck; orlop-deck, where the cables are stowed; poop-deck, with a cabin; quarter-deck, including poop-deck; spar-deck, or upper deck.

Deep Sea Explora'tion. Dredging the ocean depths to discover the conditions there existing. Many expeditions have been sent out for this purpose, the most interesting discovery being the fact that numerous animals, of peculiar forms, inhabit the ocean at great depths, numbers of them being brilliantly phosphorescent, and thus lighting up their dark abode.

Deer. [AS.] A family of ruminating animals, with slender limbs, and large antlers or horns on the head of the male animal. These are solid, and are shed annually in the spring; but new ones grow rapidly and send out branches, so that in a few months the deer has another pair of horns, each year's antlers increasing in size till the seventh year, after which they get smaller. The deer feed on vegetable substances, and they are wont to swallow large quantities without



much chewing, and masticate at their leisure; this they can do because they have a complicated stomach divided into four chambers. (See *Digestion*.) The reindeer is found in the north of Europe and America. It is used for drawing sleds; and its flesh and milk supply the natives with food, and its skin with covering. It eats moss and lichen. The horns of the wapiti, or Canadian red deer, weigh more than 60 pounds. The moose, or elk, is the giant of the Deer tribe. The fallow deer has palmated horns. The musk deer is about 20 inches in height. The musk, from which it is named, is secreted in the abdomen.—*Deer-stalking*, hunting the stag by stealing on it unawares.

Degree'. [Fr.] The 360th part of a circle; 60 geographical miles; the unit of measure for arcs and angles; divided into 60 minutes, and each of these into 60 seconds; also a distinction conferred on graduates of a college or university.

Honorary degrees are conferred on persons of distinction without examination as to their attainments.

Delf. A kind of earthenware made at Delft, in Holland; also any glazed earthenware for table use made in imitation of that.

Denuda'tion. The removal of solid matter by the flow of water in streams, or the action of the waves and currents of the seas. The process is continuous in regions of plentiful rainfall, the surface layers of the earth being gradually carried away to deposit in bays and seas.

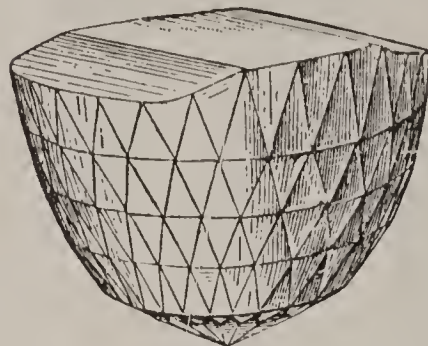
Dev'il-rish or **Oc'topus.** A highly organized mollusc without an external shell, and sometimes of great size. Its head has large staring eyes, and its eight arms or feet have two rows of suckers, which adhere to animals or objects by a curious mouth with two long teeth. Within its body is a sac with an inky fluid, which it throws from a funnel in its mouth when alarmed. This ink is used as sepia, or India ink. The name *devil-fish* is sometimes applied to the *fishing-frog*, and in America to a gigantic species of *ray*, one of which has been found in Delaware Bay weighing 5 tons.

Dew. [AS.] The name given to the drops of water which are seen on the leaves of plants on bright mornings, more especially in the spring and autumn. The air contains aqueous vapor, and the amount of vapor which the air will carry increases as the temperature of the air rises, and diminishes as it falls. When the air contains as much vapor as it is capable of taking up at any particular temperature, it is said to be *saturated*; and when it is cooled below the point of saturation, condensation takes place, and the moisture deposited in this way from the atmosphere is termed *dew*. The temperature at which dew begins to be deposited is termed the *dew-point*. When the sky is clouded, the greater part of the heat radiated by the earth is reflected back from the clouds, and the temperature of the air does not sink to the dew-point. It will be found that on cloudy nights there is no deposition of dew. The air should be still, otherwise no air remains long enough in contact with the ground to be cooled to the dew-point.

Dew'berry. An American species of blackberry, with prostrate stems, abundant in dry, stony fields from Canada to Virginia. Its fruit is of large size and delicious taste, being much superior to the high blackberry. There is a British fruit of the same name, but not nearly so palatable.

Di'al. [L. *dies*, a day.] An instrument constructed to show the hour of the day from the position of the shadow of a style cast by the sun on the face of a dial-plate. It consists of a straight rod or style attached to a plane surface, which is graduated in such a way that the shadow points to the correct time of day as shown by the sun. The style is placed in a direction parallel to the earth's axis. The time shown by a sun-dial is true solar time.

Di'amond. [Fr., from Gk. *adamantos*.] The hardest and next to the ruby the most valuable of gems. Chemically, it is pure, crystallized carbon, its crystalline form belonging to the regular or cubic system, having generally eight or twelve



THE ORLOFF DIAMOND.

faces. The best diamonds are perfectly clear and colorless, and are described as being of the *first water*. The peculiar lustre of the diamond distinguishes it from all other substances, and the vivid brightness and intense glow of its reflections are unsurpassed by any other stone. It is also distinguished from other gems by its extreme hardness. The value of a diamond is greatly enhanced by cutting. This industry was at one time confined almost exclusively to Amsterdam, but it is now carried on in other places. Diamonds are cut in two forms—the *brilliant* and the *rose* cut. The former brings out better the beauty of the stone. The dust is used by the lapidary and the gem-engraver, and the stone is used for jewelling watches and in cutting glass, and for the latter purpose it must not be cut. Inferior sorts are used by engineers in rock-boring, and by copper-plate engravers as etching-points. Diamonds are found in India and Borneo, and sometimes in North America and Australia; but the chief diamond fields of the present day are those of South Africa and Brazil. They were first discovered in South Africa in 1867, existing there in a blueish earth, from which they are washed out. An immense number of diamonds, of great collective value, have been obtained from these mines. Among the large diamonds found the most famous is the Koh-i-noor, which has a very interesting history. Others are the Great Mogul, the Orloff, the Regent, and the Sancy.

Di'aper. [Fr., corrupted from Gk. *iaspis*, jasper.] Linen or cotton cloth or towelling, woven with constantly-repeated figures like iasper. (See *Damask*.)

Di'aphragm. [Gk.] A muscle crossing the body, separating the chest from the abdomen, and forming a movable partition between these two cavities, its most important office being connected with the function of respiration.

Di'atoms. The name of a family of minute plants, inhabiting seas and rivers, each consisting of a single organic cell, inclosed in a double case of silica, the two halves fitting together like a box and its lid. They exist in vast multitudes and of many different forms, being visible only under the microscope.

Die. [F.] A stamp, often one of a pair, used in marking coins, in forging metals, and in striking sheet metal. Dies are always made of the finest steel, and the figures on the die are cut by small steel tools. Book-stamps are cut in brass instead of steel.

Digest'ion. [L.] The power of dissolving and distributing food over the body. All vertebrates have a mouth, which is generally furnished with teeth. The food is mostly cut and divided in the mouth and mixed with saliva, after which it is swallowed and digested in the stomach (*q.v.*) by gastric juice, and in the intestines by bile and pancreatic juice, the nutritious portions being absorbed in the blood. In shell-fish, after food is crushed by hard plates in the stomach and mixed with saliva, it passes into a long intestine, where the nutritious parts are absorbed into the blood. Insects pass the food into a crop and then into a gizzard, where it is crushed and passed into the true stomach and intestines.

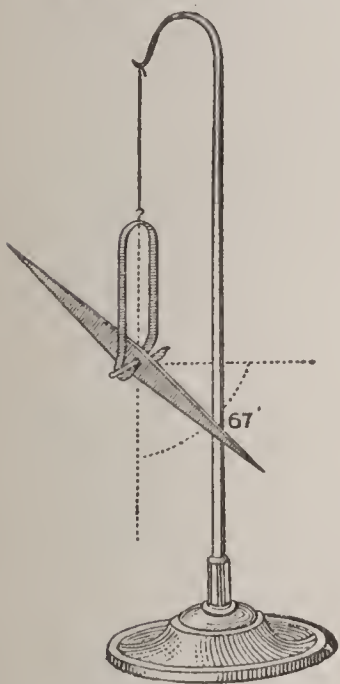
Digit'alis. A genus of plants of which the best known species is the common foxglove, which bears handsome flowers—large, rosy, spotted within with white and purple, and hanging gracefully. The leaves have an acrid, bitter taste, and an overdose of them is poisonous. Employed in small doses, digitalis is a useful medicine, being very useful in diseases of the heart, and in inflammation.

Dike. [AS.] Earth dug out and raised up in a bank; also a wall of turf or stone. In geology, a volcanic rock filling up fissures in the strata.

Dim'ity. [L.] A cotton cloth used for curtains. It is plain or twilled, sometimes in colors.

Diphthe'ria. A very malignant disease of the throat, mainly attacking children, and often fatal. It is a contagious disease, due to the presence of noxious bacteria, and has been successfully treated by inoculation with an anti-toxin, or serum, produced by culture of diphtheria germs.

Dip'ping=nee'dle. An instrument for measuring the dip or inclination of the compass needle to the horizon, and from this fact it is also termed the *inclination compass*. It consists of a magnetic needle very accurately mounted on a horizontal axis.



DIPPING NEEDLE.

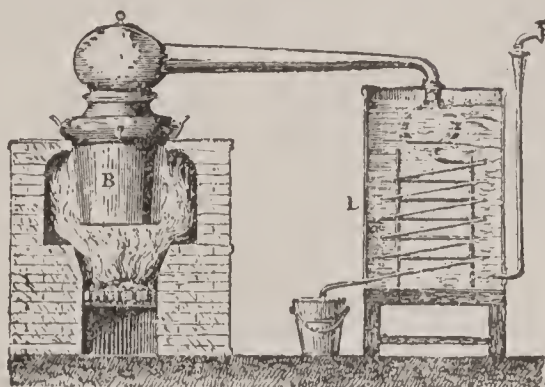
Disc or Disk. [AS., from Gk.] The round surface of a plate or star. In owls, the space around the eyes. A disc engine is a kind of rotary engine.

Disinfect'ant. An agent for destroying the germs of infectious diseases, or for removing by oxidation the organic matter in which germs develop. Some of the substances used for this

purpose are sulphurous acid, obtained by burning sulphur, corrosive sublimate (mercuric chloride), chloride of lime, carbolic acid, Condy's fluid, and green vitriol (ferrous sulphate).

Distilla'tion. This process consists in boiling a liquid and condensing the vapor which is formed. The liquid, which we may suppose to be water,

is heated in a vessel. The steam or vapor, as soon as it is formed, is made to pass through a coil of pipes, placed in a vessel of cold water.



While passing through this coil, the vapor parts with its heat to the cold water, and on condensing is drawn from the end of the worm. The vessel must

be constantly

replenished with cold water, and the heated water allowed to run off, otherwise the condensation would soon cease. The object of distillation is generally to free the liquid from any impurities it may contain, and also to separate a more volatile liquid from one less so, such as alcohol from water.

Div'ing-bell. An apparatus in which persons may be let down and remain for a considerable time under water without much inconvenience or danger. It is a large vessel, closed at the top and sides, but open at the bottom. It takes its name from having been originally shaped somewhat like a bell; but it is now generally made square at the top and bottom, the bottom being somewhat larger than the top. The bell is used in blasting rocks under water, in examining the foundations of piers and bridges, and in recovering stores and treasures from sunken vessels. A code of signals has been arranged by which those below can make known their wishes to others stationed at the top. Dresses have now been devised which enable divers to work under water without the aid of a diving-bell. The dress is made of india-rubber cloth, and covers the entire body. The head is covered by a helmet provided with eye-holes covered with strong glass. Air is supplied through a tube which enters the head-piece, and is connected with an air-pump above. A dress of this kind is now much used by those who dive for pearls, sponges, and coral.

Dock. [Du.] An artificial place with gates, for ships being loaded or unloaded. The *dockyard* is the place near the dock where stores for ships are kept. A *dry dock* is one from which the water has been pumped out, and is fitted with appliances for making or repairing ships, and includes graving-dock, floating-dock, and hydraulic dock. A *wet dock* is the name for a dock with water shut in at a fixed level, and opened or shut according to the state of the tide.

Dog. [O.E.] The dog is a carnivorous quadruped, and belongs to the same family as the fox, the wolf, and the jackal. It has long been domesticated, and is the faithful companion of man, having followed him into every part of the world. There are many varieties, which are carefully bred. They include the large and useful Eskimo, Newfoundland, and St. Bernard breeds; the various long and slender hounds, the pointer,

setter, and other hunting dogs; the alert little terrier; the water-loving spaniel; the watchful mastiff; the fine and powerful bull-dog; the highly intelligent collie or sheep-dog, and various others.

Dog'fish. A small shark of many kinds. The European spotted dogfish is abundant; the American dogfish is sometimes called the blue dogfish; the common dogfish, both in America and Europe, is horned.

Dog'star. Sirius, the brightest of the fixed stars in the Canis Major or Greater Dog constellation. The conjunction of the rising of the dogstar with the rising of the sun was thought by the ancients to be the cause of the great heat of summer and the consequent sickness, and the period of six weeks from the middle of July was hence named *dog-days*.

Dog'wood. The American dogwood is a small but very ornamental tree, bearing flowers surrounded with large white bracts, and scarlet berries in winter. The bark is a useful febrifuge. The European dogwood is a shrub whose foliage becomes deep-red in autumn. Its wood is very hard, and is used for skewers, cogs for wheels, etc., and also makes the best charcoal for gun-powder.

Dol'lar. [Sax.] A silver coin of different value in different countries. In the United States the silver dollar weighs 412½ grains. The name is an abbreviation of Joachim's thaler, first coined in 1518 in St. Joachim's Valley, Bohemia.

Dol'phin. [Fr.] A mammal smaller than the true whale, and common in all seas. It is more elegant than the porpoise, and is distinguished by its long snout. Dolphins follow vessels in companies, leaping out of the water and tumbling about. They chase flying-fish relentlessly, and prey on small fish, and often follow them into shallow waters or up rivers. In color the dolphin is black above and white below, but it is said to change its color when dying. Its head is peculiarly shaped—round above and long like a beak.

Dom'ino. [Ital.] A kind of hood worn by the canons of a cathedral; a mask. Also a small piece of wood, bone, or ivory marked by from one to six dots, or blank, for playing the game of dominoes. The game is played by matching the dots.

Dor'mouse. A small rodent animal that sleeps in winter. It lays up a winter store of nuts, and does not bury them, but prefers to hide them in the tree, which serves for a home. It weaves a nest of grass blades, like that of the harvest mouse.

Dove. [AS.] A bird of the genus *Columba*. It is the same as the pigeon, there being no distinction in the terms. The European turtle-dove has a sweet plaintive note; the ring-dove is the largest; the sea-dove is the little auk.

Dove'tail. [O.E.] The ends of two boards fitted into each other by one being cut the shape of a dove's tail. The one is called a tenon, and the other the mortise or socket.

Drag'on. [Fr., from Gk., a serpent.] A fabulous winged serpent; a small tree-lizard or flying-lizard of several kinds found in the East Indies



and Southern Asia. Five or six of the hind ribs on each side are prolonged and covered with a web-like skin, forming a kind of wing. This wing aids it in flying or leaping from tree to tree.

Drag'on=fly. An insect with a large head and great eyes, and a white, scarlet, blue, and green long sharp body, and four strong gossamer-like wings. It preys on flies, gnats, mosquitoes, and butterflies. It lives mostly about water, and lays its eggs in the water, in which the larvæ are hatched. The pupas are not inactive, as in many insects, but are voracious insect-eaters.

Dragoon'. [Span.] A soldier who used to fight either on foot or horseback, with a musket carved with dragons; a horse-soldier with a helmet.

Drain. [AS.] An arrangement of channels for draining off water from houses or fields. House-drains are glazed and water-tight.

Drainage=tubes. A recent appliance used in surgery. The tubes are of india-rubber, perforated with numerous holes, and are introduced into chronic abscesses and large wounds to draw off the pus as formed. In some cases tubes of glass, or of decalcified bones are employed.

Draughts. A game for two persons, each with twelve round pieces of different colors, played on a board marked with black and white squares.

Dredge. [Fr., from Du.] A scoop for bringing up mud from the bottom so as to deepen rivers or docks; also a drag-net to sweep the bottom of streams or seas for other purposes.

Drill. [Du.] An instrument for boring, usually with an edged or pointed end, and cutting by revolving. Diamond drill is a rod set with diamonds for boring rock.

Drom'edary. [Low L.] The African or Arabian camel, which has but one hump. (See *Camel*.)

Dross. [AS.] The impure portion or dregs which sinks to the bottom, or the scum which rises to the top, especially from metals when ore is smelted.

Drug. [Fr., or from *dry*.] Something dried to make a medicine. Applied to medicinal agents used in the treatment of disease, or more generally the crude substances which, after they have undergone preparation, are usually called medicines. To be *drugged* is more particularly applied to those suffering from a narcotic medicine, which produces stupor, and sometimes death.

Drug'get. [Fr.] A coarse cloth dyed of one color, made of wool, to protect carpets.

Drum. [O.E.] A large tube with tight skins over the ends, beaten to accompany music—a kettle-drum has a metallic hemisphere, and a single piece of skin to be beaten; the tympanum or stretched membrane in the inside of the ear; a broad wheel on a revolving shaft, round which a belt is put to drive another wheel.

Dry'ing Machines. Machines for the rapid drying of fabrics or other materials by centrifugal force. They revolve so rapidly that the water is thrown off from the enclosed substance. The centrifugal process is also used as the final stage in sugar production, the sugar being placed in a perforated cage, and the machine whirled round at a speed of 1,000 rotations a minute. This throws off the molasses, and leaves the sugar crystals nearly white. In paper-making machines are fans which drive heated air against the inner surface of the paper, rapidly drying it.

Duck. [O.E.] A well-known swimming-bird, whose boat-shaped body and long neck and webbed feet adapt it to live in the water. Its body is covered with a thick and close plumage; its coat of down is very thick; and it has a large supply of oil in an oil-gland which keeps its feathers from getting wet. Its flat bill is supplied with rough plates around the edge, which form a good strainer, and so it can pick its food from the mud and water it takes into its mouth. Ducks are kept on farms for the sake of their eggs and their flesh. The feathers are also of use for bedding, those of the eider duck (*q. v.*) being especially soft and fine. River ducks include the common domestic duck, the wood-duck, the mandarin or Chinese duck, and the

Muscovy duck, originally of South America. The steamer-duck of South America cannot fly, but swims swiftly.

Dye'ing. [AS.] A process consisting in fixing the color in cloth and other materials by immersing them in a prepared bath containing coloring substances. Dyes are obtained from animals, vegetables, and minerals, the different tints being secured by combining the requisite number of simple coloring substances with one another. In order to render the colors permanent, mordants are used. These consist chiefly of the salts of iron, alumina, and tin. With aniline and some other dyes no mordant is required. Indigo is the chief of blue dye-stuffs; quercitron and fustic dye yellow; and madder, log-wood, cochineal, and aniline dyes are the most common red dyes.

Dynamite [Gk. *dynamis*], or **Giant Powder.**

The general name for various explosives, prepared by mixing nitro-glycerine with some absorbing substance which prevents leakage. The materials used for this purpose are sawdust, silicious marl, rotten-stone, tripoli, the meal of Indian corn, sponge plaster, and an infusorial earth known as "keiselguhr." Its explosive powers are very great, while it is far safer to handle than nitro-glycerine. It was discovered in 1867 by Alfred Nobel, a Swedish chemist.

Dynamo. [Gk.] A machine used for generating a current of electricity by the rotation of coils of wire with iron cores between the poles of a powerful electro-magnet. When any conductor of electricity is moved about in the space surrounding the poles of a magnet so as to cut the lines of force at right angles, currents of electricity are produced in the conductor. In magneto-electric machines permanent magnets are used; but when an electro-magnet is substituted for the permanent magnet, the machines are termed "dynamos," or dynamo-electric machines. Dynamos are used for electric lighting; also to operate electric motors on cars and in factories to drive machinery—the motor being simply a reversed dynamo.

E

Ea'gle. [Fr., from L. *aquila*.] A large vertebrate bird of prey of the Falcon family, with a short, sharp, hooked beak; short, strong feet; very strong, sharp, hooked claws (*q. v.*); and a long tail. It has keen vision, is solitary in its habits, and builds its nest usually on the top of a lofty tree in a swamp, or on some rocky peak, of large sticks and branches heaped together. It uses the same nest year after year. It feeds on birds, squirrels, hares and rabbits, and lambs from the flock, seizing its prey, not with the beak, but with the talons (*q. v.*), sometimes driving its breast-bone straight against what it wishes to kill. The most noted species are the golden eagle, the imperial eagle, the American white or bald eagle, and the European sea-eagle. The golden eagle is a fine large bird. Its nest is roughly made up,

and often measures five feet square. The young eagles never number more than four, and are hatched in thirty days. This bird, on perceiving its game, circles in the air, and then slowly descends in decreasing circles till the prey is caught. The bald or white eagle is about the size of a small hen turkey. Its head is not really bald, but covered with thick, white feathers, which give it this appearance. Its feathers are of a brownish-black color. It loves fish, but does not catch them itself. Instead, it watches the fish-hawk or osprey at its work, and when it sees that the hawk has caught a fish, it swoops downward and forces it to yield its prey.

The eagle was the emblem of ancient Rome, and is now the emblem of the Austrian and Russian empires, and of the United States. The

Austrian and Russian eagles are made with two heads, in imitation of the double-headed eagle first used by Constantine the Great, one of the heads of which meant the Western Empire, and the other the Eastern Empire.

Eagle, a gold coin of the United States, whose value is ten dollars. It was first coined in 1795. The half eagle was first made in the same year, the quarter eagle in 1796, and the double eagle in 1849. These coins are not pure gold. The eagle was named from the emblem of the United States.

Ear. [AS.] The mechanism through which sound reaches the brain. In man and the higher vertebrates the ear is divided into three parts—



the outer opening, or meatus; the middle ear, or tympanum or drum; the inner ear, or labyrinth. The membranous labyrinth consists of a number of sacs and tubes containing a lymph

fluid, which fills a cavity known as the bony labyrinth. The sound collected by the outer ear sets the tympanic membrane vibrating; the bones in the middle ear convey these vibrations to the inner ear, where the fibres of the auditory nerve receive them and send them to the brain. A passage called the eustachian tube opens from the inner cavity into the throat. When through cold the throat is swollen, the mouth of this tube may close and deafness ensue. The ears of animals of prey bend forward to collect the sounds in the direction of the pursuit. The ears of animals of flight, as hares and deer, turn backward to catch the sounds that may warn them of approaching danger.

Earth. [AS.] One of the planets of the solar system, coming next to Mercury and Venus in the order of distance from the sun. The principal motions of the earth are (1) its daily revolution on its axis; (2) its yearly revolution in its orbit round the sun. It was long believed that the earth stood still and the sun, planets, and stars revolved around it, but astronomers have proved that the earth moves round the sun, completing one revolution in about 365 days 6 hours. The orbit is an ellipse, with the sun in one focus, so that the earth is not at the same distance from the sun at all periods of the year; the mean distance is about 92,800,000 miles. The motion of the earth in its orbit explains the apparent motion of the sun in the heavens during the course of the year. Many general considerations suggest to us the globular form of the earth. When a ship is sailing away from the land, the hull will be seen to disappear while the masts are still visible, and by degrees the masts also sink below the horizon. If the sea were flat, the body of the vessel would be visible as long as the masts. Mariners also have sailed

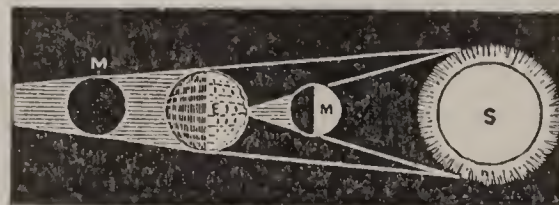
round the earth, always steering in the same general direction. Measurements made at different parts of the earth's surface show that the length of a degree increases towards the poles, and that consequently the earth is not a perfect sphere, but is flattened at the poles. Its mean diameter is 7,918 miles, and circumference 24,875 miles, while it moves around the sun at a speed of 15 miles per second. The mass of the earth is rather more than five times as great as that of a globe of water of the same size would be. It has been found that the temperature increases about 1° F. for every 64 feet of descent. If the temperature were to increase at this rate inwards, then at no great depth the heat would be sufficient to melt the ordinary materials of the crust known to us. Hot springs and volcanoes show that the interior of the earth is much warmer than the exterior. It is therefore supposed that, though the materials in the interior are at an exceedingly high temperature, yet owing to the great pressure under which they exist they are most probably in the solid state.

Earthquake. A movement or shaking of some part of the surface of the earth, resulting from a shock inflicted on a solid portion of the earth at some point below the surface. Earthquakes occur with most frequency in volcanic regions. A few of the more remarkable earthquakes of modern times were those of Lisbon in 1755, Lima in 1746, Peru and Ecuador in 1868, and the Riviera in 1887.

Eb'ony. [Fr., from Heb.] A kind of wood, usually black, hard, and heavy, which can take on a fine polish. The finest is the heart wood of a tree found in Mauritius. Other trees in Ceylon and the East Indies also yield ebony. A leguminous tree in the West Indies yields green ebony. It is used for ornamental cabinet work, mosaic, flutes, knife handles, pianoforte keys, etc. Most of the furniture called ebony is made of cherry-wood dyed black.

Eccen'tric. [Fr., from Gk.] A wheel or revolving disk, whose axis of motion is not in its centre. By its use circular motion can be converted into intermittent motion. Eccentrics are used to work the valve-gear of steam engines and for many other purposes.

Ech'o. [Gk.] A sound reflected back to the ear. It is caused by the sending back from a reflect-



ECLIPSE OF THE SUN.

ing surface of the undulations which produce the sound. The most remarkable echoes are one at Lurlei on the

Rhine; those at the Whispering Galleries at St. Paul's, London, the Observatory, Paris, and the Capitol, Washington, and those on some of the lochs in Scotland. (See *Focus*.)

Eclip'ses. [Gk. *ekleipsis*, a failing.] When a body which does not allow light to pass through it (an opaque body) is exposed to the light of

the sun or of any other luminous body it casts a shadow behind. *An eclipse of the moon* is caused by the moon entering the shadow of the earth; which can only happen at the time of full moon, when the earth lies directly between the sun and moon. *An eclipse of the sun* takes place when the moon, coming between the earth and the sun, intercepts the sun's light. This can only happen at the time of new moon, when the moon comes directly between the sun and the earth. Usually the moon hides the whole disc of the sun, producing a *total eclipse*; but occasionally a thin band of sunlight is visible round the edge of the moon, and then we have what is known as an *annular eclipse* (*annulus*, a ring). This is because the moon is not always at the same distance from the earth when the eclipse happens, and at its greatest distance the apparent size of the moon is less than that of the sun. If the moon is a little out of the central line between the earth and sun a *partial eclipse* is produced.

Eel. [AS.] A kind of fish with a strong smooth skin, a vast quantity of small scales, and a long thin body. Though it has the head of a fish it has no gill covers, but only a small hole. Its dorsal and anal fins run along nearly one-third of the body, but some species are nearly destitute of fins and have no scales. Eels mostly abound in waters which communicate with the sea and some species live only in sea-waters. The freshwater eel can creep over the ground like snakes, and sometimes passes the winter in a torpid state in mud. It has transparent horny coverings to defend its eyes from mud and stones. Eels are the terror of most other fish, and attack their prey by day and by night. The murry eel abounds in the Mediterranean and other warm seas, and the Romans esteemed it a delicacy. Eels are caught by eel-bucks, eel-sets or nets, and bobs or worms and worsted. *Electric eels* are found at the mouth of the Orinoco in pools after a flood, where they are harpooned by the natives, who drive wild horses into the water to receive their electric shocks. These eels are large, yellow, and livid, and arch their bodies, straightening themselves with a jerk, and curving back again when they produce the shock. The shock is severe enough to knock down men or animals. The electricity is generated by cells in the lower part of the body, and the number of cells varies according to the size of the fish.

Egg. [AS.] A roundish or oval-shaped body laid by birds and other animals, and from which their young come forth. The egg of the bird consists of a yolk with a germ-cell, which is surrounded by white albumen and enclosed in a shell. The germ-cell occupies little space, but it is of great importance, since from it the bird develops. Twisted cords of albumen allow the yolk to roll over when the egg is turned, but the germ-cell always keeps uppermost, and so is always nearest the body of the bird as she sits on her eggs, and thus receives the most heat. In growth the albumen furnishes the matter for the body of the young bird, and the yolk affords its nourishment. The bigger the yolk the larger will be the

young chicken. There is at the top of the egg a little bubble of air for the use of the young bird, and fresh supplies of air pass through numerous small pores in the shell. The young bird, when sufficiently grown, chips the shell by a little knob on its beak; which disappears after it has come forth from the shell. An ostrich egg will weigh three pounds, and contain as much as one dozen hens' eggs. Ostrich eggs are left in the sun to hatch. Alligators place theirs under a mass of vegetable matter heaped up on purpose to produce the heat necessary for hatching. Turtles lay from 100 to 200 eggs, and cover them with sand, carefully smoothing the place where they are left to hatch in the heat of the sun. The female shark lays but two eggs, which are enclosed in leathery purse-shaped cases, with the four corners lengthened into tendrils, and these becoming entangled in sea-weed hold the egg in its place. The empty black cases of sharks' eggs are often found on the sea-shore. The eggs of fishes are tiny, covered with a thin skin, and so transparent that the fish can be seen moving inside for a day or two before being hatched. A single cod-roe will contain 9,000,000 eggs, but great myriads of fish are devoured when young by their larger neighbors. The eggs of frogs are scattered through a lump of thick jelly, which sticks to grass or twigs, and so is prevented from drifting away by that which affords food to the young animals. Many snakes lay eggs, which like those of the frog are stuck together by a thin jelly. Snails deposit tiny white eggs, which contain perfect little snail-shells within. The eggs of ants are scarcely visible. The queen ant lays all the eggs, which are immediately taken in charge by nurses that lick and clean them till little white grubs are hatched. The queen bee lays all the eggs of bees, sometimes 2,000 in a single day, and each egg is placed in its own special cell—worker eggs in worker-cells, and drone eggs in drone cells. After a few days the eggs hatch white grubs, which are attended by nurses. Nearly all spiders enclose their eggs in a silken cocoon, which, in some species, the mother carries on her back: 2,000 young spiders have been found in one cocoon. The eggs of domestic fowls are very nutritious.

Ei'der Duck. [Scand.] A sea-bird, which spends the winter on the Arctic seas, and when spring comes swims with its mates to the shore. The female makes a large, loose nest of dry grass, and lines it with a thick layer of down plucked from her own breast. The natives rob the nests of this down, and when it is replaced rob them a second time. Then the male bird strips himself of his down to line the nest, which is now left undisturbed. The female lays from six to ten pale-green eggs. Eider down is valuable for its softness and lightness, and the eggs are much liked as food. The eider duck does not fly well, but is early taught to swim and dive, the mother going down to the sea with a little one under each wing.

El'der. [AS.] A small tree or shrub with soft pith, white flowers, and black, red, or purple berries.

The berries are diaphoretic and aperient. Elder-flower water, made from the flowers, is a perfumed water used in perfumery and confectionery.

Electric'ity. [Gk.] This name was originally applied to certain attractions and repulsions, but the subject has gradually widened so as to include

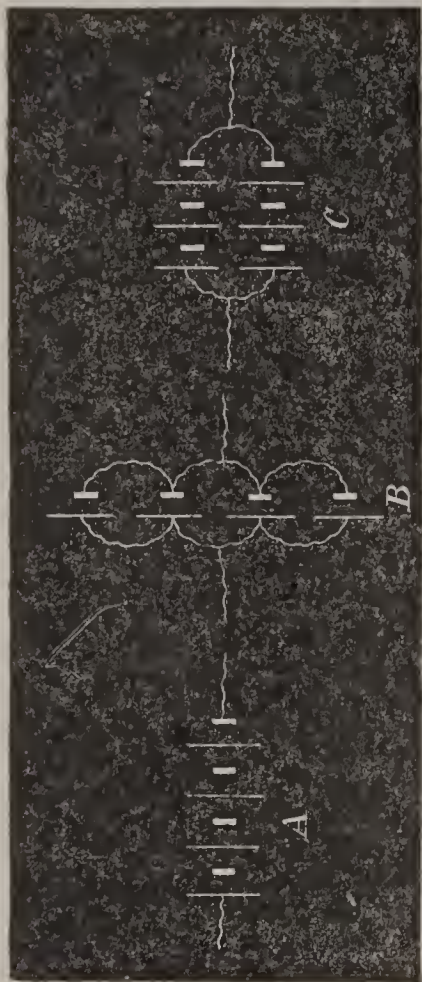


Diagram Showing: A, four cells in series; B, four cells in parallel; and C, three in series with two in parallel.

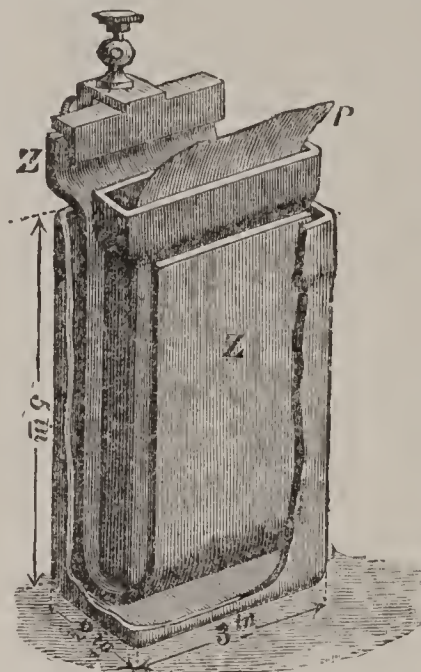
various chemical heating, luminous, magnetic, and mechanical effects. Electricity is considered under the two heads of (1) Static or Frictional Electricity; and (2) Current or Voltaic Electricity.

Static Electricity.

As early as 600 B.C., Thales and other Greek philosophers discovered that amber (hence the name electricity, from Gk. *electron*, amber) when rubbed with silk attracted light bodies; and about 1600 A.D., Dr. Gilbert found that glass, sulphur, sealing wax, resin, and many other bodies were possessed of the same property. When glass is rubbed with silk, the glass is said to be electrified *positively*, and the silk, which has been the rubber, *negatively*; but wax

rubbed with silk or flannel is *negatively* and the silk *positively* electrified. The existence of two kinds of electricity is shown as follows: A small pith ball is hung by a silk thread from a glass support, forming an electric pendulum. When a glass rod which has been rubbed with silk is brought near the pith ball, the ball is attracted by the glass; but as soon as it touches it, repulsion follows, and the two separate. If now a stick of sealing-wax be rubbed with silk, and brought up to the pith ball, the latter will be attracted towards the wax although it has just been repelled by the glass. This shows that a pith ball touched by electrified glass is afterwards repelled by the electrified glass, but attracted by electrified sealing-wax. This experiment shows two things: (1) that there are two kinds of electricity; (2) that two bodies charged with like electricities repel one another, and those charged with unlike electricities attract. The electricities here called positive and negative are also known respectively as *vitreous* and *resinous*. The electricity produced by friction has great electro-motive force, and is thus capable of overcoming great resistance, and of producing powerful mechanical effects; but it is deficient in quantity, and therefore does not possess a large amount of energy.

Current Electricity. A galvanic or voltaic cell or battery is an arrangement in which electricity is yielded by chemical action. Such electricity is named *current*, because it is continuous while the chemical action lasts, and not intermittent, like the momentary discharge from a Leyden jar.



GROVE'S CELL.

Z, zinc plate in dilute sulphuric acid; P, platinum plate in strong nitric acid.

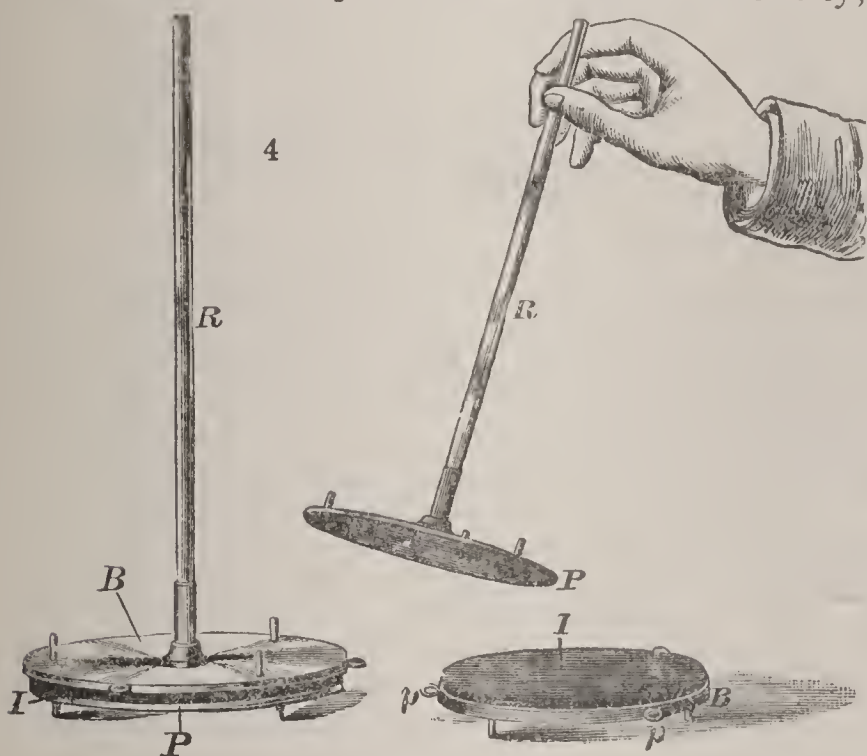
A current may also be generated by heating the junction of two dissimilar metals; the electricity obtained in this way is called the thermo-electric current, the heat being transformed into electricity. Another method of obtaining a current is by rotating a coil of wire between the poles of a magnet or of an electro-magnet, as in the dynamo which yields electric light and power. The chief subjects which require to be considered under the head of Current Electricity are (1) the effect of the current in producing chemical decompositions; (2) in producing heat and light, as in electric lighting (*q.v.*); (3) the production of induced currents by the action of another current or of a magnet; (4) the measurement of the strength of the current, as with the galvanometer. (See *Galvanometer*, *Ether*.)

Electric Light. Two forms of electric light are used—the *arc* and the *incandescent*. When a strong current passes between two carbon points which have been first in contact and are afterwards separated a short distance, the interval between them is occupied by a luminous band (known as the voltaic arc). This constitutes the *arc* light. Its light is very intense. The common street light is equal to about 800 candle-power, but the powerful search light may equal more than 50,000,000 candles. In the *incandescent* lamp the current is made to pass through a strip of carbon which has been carefully prepared and formed into a loop. This becomes intensely hot, and gives out much light. It is enclosed in a small glass globe, from which the air must be removed or a vacuum formed, otherwise the heated carbon would unite with the oxygen and the air be consumed. This light is suitable for household use. The current is supplied by an electro-magnetic machine.

Electric Tele'graph. A system of conveying intelligence to a distance by means of signals produced by aid of the electric current. The two stations, which may be several thousand miles apart, are connected by a wire along which the electricity flows. The electric current, produced by a galvanic battery, passes along the wire with immense velocity, and is capable of acting upon an electro-magnet at great distances. In the common Morse system the sender uses a small

instrument, by tapping which with his finger he can break off the current at will. When this is done quickly the receiving instrument gives a quick sound, or makes a dot on paper. When slowly, there is a longer sound, or a dash on paper. These dots and dashes are variously combined to represent the letters of the alphabet. These are now caught by the ear, paper not being used. Telegraph lines are usually carried through the air on wooden poles, galvanized iron being used. Telegraphs also pass under the oceans, their wires being surrounded by insulating material, the whole being called a cable. Telegraphing without wires has recently been invented.

Elec'tro-met'allurgy. The art of depositing metals—such as gold, silver, copper, etc.,—from their solutions by a slow current of electricity,



ELECTROPHOROUS.

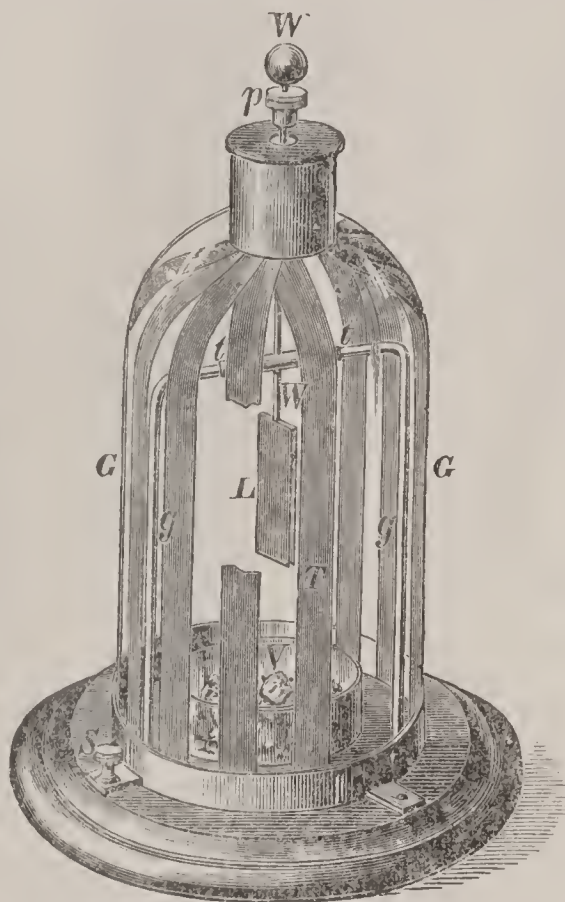
I, Ebonite plate; B and P, upper and lower plates of brass; R, insulating handle for upper plate.

obtained either from a voltaic or a magneto-electric battery. The process is mostly confined to electro-typing and electro-plating.—*Electro-typing* is the method of securing copies of medals, statuettes, etc. When copper, for example, has to be deposited upon a mould (made of plaster of Paris or gutta-percha), the mould is made a conductor by brushing it over with black-lead; and, after attaching it to the negative pole of the battery, it is suspended in the solution of sulphate of copper, the positive pole consisting of a plate of the same metal. By the electrolysis of the solution copper is deposited on the surface of the mould, while sulphuric acid is set free; and this, by dissolving a portion of the copper at the positive pole, keeps the solution at constant strength.—*Electro-plating* is the process of covering forks, spoons, etc., made of the cheaper metals, with a coating of silver. The process is in reality electro-typing in silver instead of copper. The solution of silver (called the bath) consists of two parts of cyanide of silver, 10 of cyanide of potassium, and 250 of water. By the electrolysis of this solution silver is deposited on the object which is placed in it.

Electroph'orous. An apparatus for generating frictional or statical electricity. By striking or rubbing the ebonite with dry flannel and then placing thereupon the upper plate of metal and touching the upper and lower metal disks simultaneously, upon removing upper disk a discharge of electricity will be then felt upon touching the upper disk.

Electrom'eter. An instrument for measuring the force or power of an electric current.

Elec'troscope. An instrument for measuring or detecting pressure of electric current. By rubbing a glass rod with a piece of silk and touching the knob W, the strips of gold leaf will part indicating pressure of electricity.



GOLD-LEAF ELECTROSCOPE.

G G, Glass shade; L, gold leaves supported by wire w; gg, glass supports for w; v, vessel containing sulphuric acid; p, small plug to be pressed down when instrument is not in use.

El'ements.

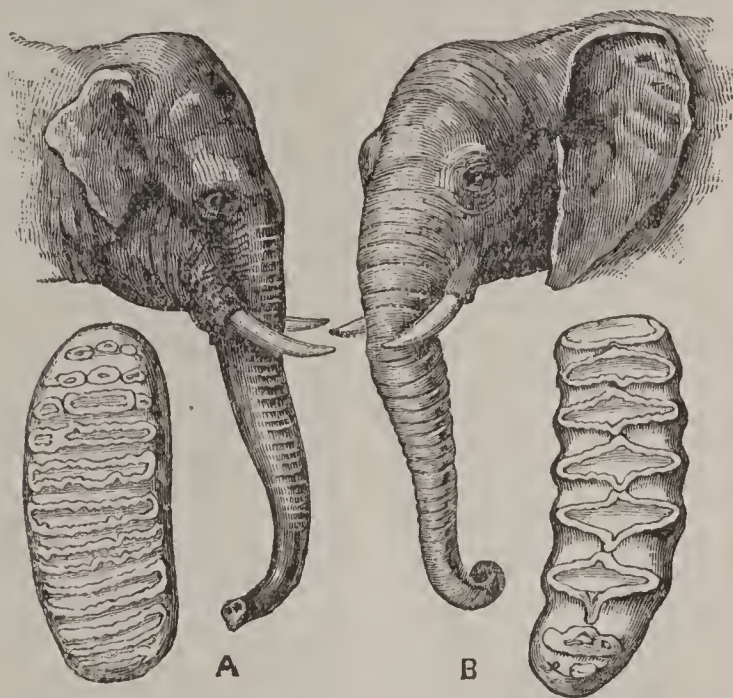
[L.] Substances which cannot be decomposed by chemical action, and which seem to be unit forms of matter, as distinguished from compounds. They are roughly divided into two great classes—the metals,

and the non-metals or metalloids. The number of elements

now known is about 75, but some of these may not be simple bodies, but compounds of simpler bodies.

El'ephant. [Heb. *aleph*, an ox.] The largest and most powerful of four-footed animals. It is clumsy and thick-skinned, but has a lithe and agile trunk. Some elephants have been found 12 feet high and over five tons in weight. They can carry great burdens at a rate of two or three miles an hour. Their legs are massive, but they can kneel and rise easily, and can use their fore feet as hands in holding down branches while the leaves are being stripped off by their trunks. The feet of the elephant are divided into toes, though externally gathered into a round cushion mass, protected by flattish nails. Compared with its body, its head is small, and the skull contains many hollow spaces, which lessen its weight. It has pendulous ears, gigantic tusks in the male, and a trunk which can reach 8 or 10 feet. The tusks, which are the incisor teeth of the upper jaw, are weapons of defence or forks to dig up roots. The eye is small but brilliant, and its inability to look backward or upward is made up for by great acuteness of hearing. The

trunk, which is the nose lengthened out, is of a tapering form, and is composed of thousands of minute muscles, which give it great power in feeling and grasping, or in pumping up or ejecting water. The trunk conveys the food to the mouth or draws up water which is thrown over the back. The elephant is herbivorous, and feeds on grass, young shoots, and roots; it is found in Central and Southern Africa, and in India. Elephants are captured by enclosing them in palisades



of timber. They are intelligent and sagacious, and can be trained to do many kinds of work and many feats. The African elephant has great flapping ears, and is more fierce than that of Asia. Its tusks yield fine ivory, which is very valuable. The Asiatic elephant is smaller than the African. The tamed elephants in menageries are of the Asiatic kind.

El'elevator. [L.] A machine for raising grain, etc., to a higher floor—usually an endless chain with a series of scoops or buckets; also, a cage or platform or hoist for hoisting persons or goods. The passenger elevator is largely employed in the lofty buildings of recent times. By its aid buildings many stories high are easily used. It is called a *lift* in England.

Elk. [Scand.] A large species of deer. The European elk has long, flat horns, and is closely allied to the moose. The American elk is known as the wapiti, and is of large size, being about as large as the horse. Its horns are the finest of all deer horns, being 5 or 6 feet long, and having many branches.

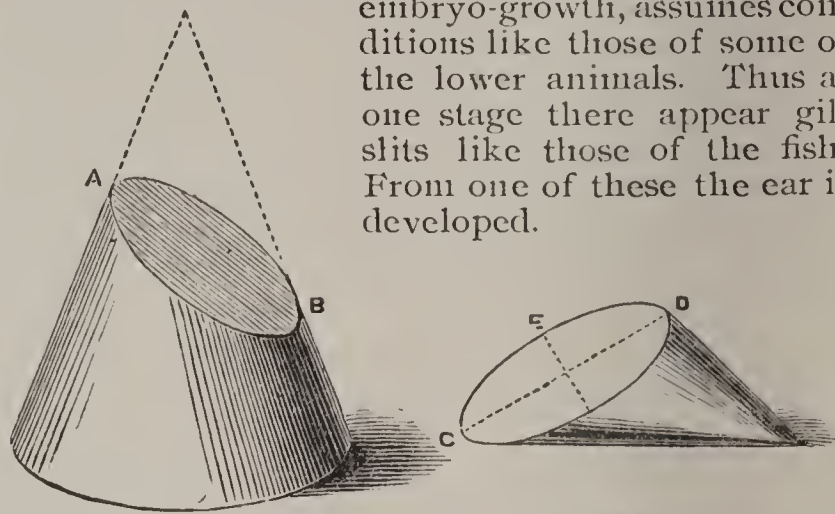
Ellipse'. [Gk.] A curve of such form that every point on it has the sum of its distances from two fixed points always the same. The two points are called the foci. The orbits of the planets are ellipses, with the sun in one focus.

Elm. [AS.] A large and graceful forest tree with thick foliage of dark-green leaves. It has smooth bark on the branches, but a rugged trunk. Its flowers are dark red, and bear an oval green pod with one seed. This tree is often planted in rows in parks, and is very common in England. Its wood is hard and tough, and used for water-

wheels, building, shipbuilding, carving, etc. Its bark is used in tanning, dyeing, and sugar-refining. The American elm is called white elm; a red elm, called slippery elm, has a succulent inner bark, whose jelly-like juice is used in medicine.

Embryol'ogy. The science of the development of the animal body from the germ to the mature state. It has been discovered that man, in the

embryo-growth, assumes conditions like those of some of the lower animals. Thus at one stage there appear gill slits like those of the fish. From one of these the ear is developed.



CONE CUT TO SHOW THE ELLIPSE.

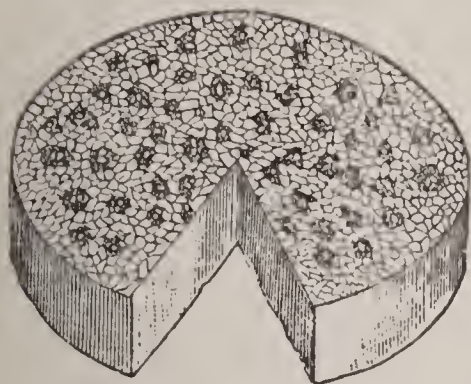
Em'erald. [Fr., from Gk.] A variety of the mineral beryl, of a beautiful green color; when transparent it is much prized as a gem. The finest stones come from Colombia, in South America, and fine ones are found in Peru. Inferior emeralds come from Bavaria, India, and Mt. Zalvra, in Upper Egypt. Large crystals of emerald occur in North Carolina and Siberia.

Em'ery. [Gk. *smān*, to rub.] A variety of corundum, occurring in grains or powder, and very hard. It is glued on cloth, paper, or the rim of a wheel, and used for grinding and polishing hard substances. It is found in the island of Naxos, in the Grecian Archipelago, and other places.

E'mu or E'meu. [Port.] An Australian bird related to the cassowary and ostrich, and, next to the ostrich, the largest of birds. It cannot fly, but runs swiftly. The emu kicks backward or sideways, while the ostrich kicks forward. Emu feathers are scarcely distinguishable from ordinary hair. The male bird hatches and broods the young. In its wild state it feeds on parrots or other birds; but it is often made a household pet, though mischievous and cunning. It is the only running bird that wanders in pairs. Its eggs are of a beautiful dark-green color.

Enam'el. [Fr., from Ital.] In pottery, a substance of a vitreous nature applied as a coating to the surface of pottery or porcelain. It is a fusible kind of glass, and is either transparent or opaque, and when transparent it forms a glaze. An enamel of a similar kind is used as a lining for the inside of iron vessels used in cooking. In the fine arts it is a substance applied as a coating for decorative purposes on the surface of porcelain or metal.—*Enamel work.* In this kind of work the chief decorative quality lies in the manner of its execution. There are distinct classes of it, as *Cloisonnee*, *Champleve*, *translucent*, and *surface enamel*.

En'dogen. [Gk.] A plant that grows by adding new wood to the interior of the stem, as a palm, rush, or orchid. Op-



posed to exogen (*q.v.*). The leaves have usually parallel veins, and their flowers are in three or multiples of three parts. Endogens have no bark, because, the flow of sap being internal, bark is not required to

defend the sap, as in exogens. The Endogens include palms, lilies, orchids, etc.

En'gine. [Fr., from *L. ingenium*.] A machine fitted to do work or set machinery in motion. There are various kinds—steam-engine, air-engine, fire-engine, pumping-engine, and donkey-engine. Military engineering includes the designing and building of fortifications; civil engineering includes the building of railways, canals, water-works, bridges, lighthouses, docks, and tunnels; mining engineering has regard to the sinking and working of mines; electrical engineering includes all kinds of electrical work.

En'signs. [*L. insignis*.] The flags of a regiment, usually two, and referred to as colors. In America they are carried by color-sergeants. The rank of ensign, formerly used in the British army, was abolished in 1871.

Ep'aulet. [Fr., from *L. spatula*.] A mark of an officer, naval or military, worn on the shoulder, formerly used.

Ep'som Salts. The ordinary name for sulphate of magnesium; so called because it occurs in a spring at Epsom in Surrey, from the water of which it was originally prepared. It is now manufactured from mountain limestone, the lime being separated by sulphuric acid. It is found native in America, and may be also prepared from sea-brine. It is used in medicine as a purgative. It has a bitter, saline, disagreeable taste, which may be somewhat relieved by adding a little lemon syrup.

Er'mine. [Fr.] An animal like a weasel, having a thick, valuable fur, worn by judges and royalty as emblem of authority. In summer it is brown, but in winter it is white. The tail is always black; and these tails are arranged at intervals through the fur when worn in state robes. It is named from Armenia, where it was first found; but now it is found in the north of Asia, Europe, and America.

Escape'ment. [Fr.] The means in a clock or watch by which the force of the weights or spring is checked and regulated by the motion of the pendulum, or balance acting on a wheel with sharp teeth. They are known as the verge or upright, the anchor-shaped, the cylinder, the duplex, and the lever.

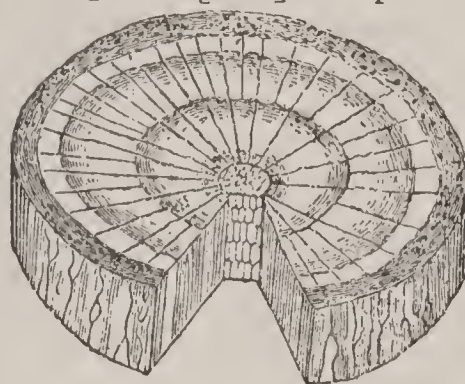
Es'sence. [*L. essentia*, being.] The volatile matter forming a perfume. Essential oils, extracted from various plants, fruits, and flowers are used in essences and perfumery.

Etch'ing. [Du.] A picture made from an etched plate, chiefly copper. In etching, the plate is covered or dabbed with a varnish, and is scored or scratched with a needle, so as to form the drawing; it is then covered with nitric acid and water, which bites the metal in the lines laid bare.

E'ther. [Gk. upper air.] A medium of extreme tenuity, which is assumed to pervade all space, and the interstices between the molecules of all bodies, whether solid, liquid, or gaseous. It is the medium by means of which light, heat, electricity, and magnetism are transmitted, it being claimed that diffused matter cannot convey these forces, and that a very rare substance, differing in character, is needed. Sulphuric ether is obtained by distilling strong alcohol and sulphuric acid, and is an exceedingly volatile and inflammable body, dissolving fats, resins, and oils, and useful in removing grease stains. It is also used as an anæsthetic.

Eucalyp'tus. [Gk.] An Australian evergreen tree like the myrtle, which grows to a great height, and yields resins, oils, tars, and tannin. The leaves are rigid, with one edge turned to the zenith. They are called *gum-trees*. The timber is valuable. The Tasmanian cider-tree is a eucalyptus, and yields a cider-like sap in spring. A eucalyptus tree in Cape Otway Range, Australia, is 415 feet high. These trees have been widely transplanted and are thought to be of value in malarious districts, as in the Roman Campagna.

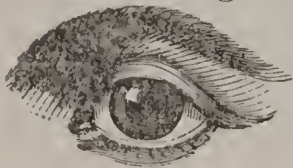
Ex'ogen. [Gk.] A plant that grows by adding its new wood round the outside of the stem, under the bark, as is done by most forest trees of the temperate zones. The leaves are usually netted-veined, and the number of cotyledons is two, or very rarely several in a whorl.



Exogens and endogens are the principal classes of the vegetable (*q.v.*) kingdom.

Eye. [AS.] The human eye is a nearly spherical ball, which in an adult is about nine-tenths of an inch in diameter. The external coating, known in common language as the white of the eye, is a tough, horny membrane, having about four-fifths of its circumference opaque, and named the *sclerotica*. The front portion of this coating, called the *cornea*, is transparent and more curved than the sclerotica. Behind the cornea is a flat circular membrane called the *iris*. It is colored, and at its centre there is a circular opening called the *pupil*, which is capable of becoming contracted or enlarged on exposure to light or darkness. The color of the iris gives the characteristic color to each person's eyes. Behind the pupil is the *crystalline lens*. The cavity between the cornea and the crystalline lens is called the *anterior chamber*, and contains the *aqueous humor*. The cavity behind the crystalline lens, called the *posterior chamber*, contains the *vitreous humor*.

The sclerotica is lined by a dark-colored membrane called the *choroid coat*, saturated with a black mucus. The choroid is lined with a membrane called the *retina*, which is traversed by a system of nerve filaments coming from the optic nerve. Light falling on the retina produces the



sensation of vision, and this is the only part of the eye which possesses this property. When the rays of light from an object enter the eye, they undergo refraction at the cornea and the crystalline lens, and come to a focus on the retina; if the image formed on the retina is distinct, the object is seen clearly. The eye can accommo-

date itself so as to be able to see objects at different distances; this is supposed to be brought about by a change in the focal length of the crystalline lens. The prawn has a pair of gleaming eyes standing out upon short stalks, which are composed of a number of six-sided facets in the shape of a hemisphere, by which the prawn keeps a sharp look-out. The snail also has eyes set on long stalks. Bees, butterflies, beetles, ants, flies, house-crickets, and other insects, have compound eyes. The eye of the grasshopper often consists of 12,000 lenses, with a glass-like cone and thread-like rods forming the image. Many of the molluscs and other low forms of life have eyes.

F

Fakir'. A member of an order of penitents or mendicants of Oriental lands, particularly India. Some of them live in communities, others wander about, making unpleasant displays of self-torture and mortification and of filthy habits. The term has recently been applied to itinerant street salesmen.

Fair'y. A fay; an imaginary being of tiny human form, supposed to dance in meadows, steal infants, and play a variety of pranks. They are regarded as sometimes benevolent, sometimes malicious, and to concern themselves greatly with human affairs. The popular belief in fairies has largely died out, but has left a literature of ceaseless charm to the young and imaginative.

Fahr'enheit. A method of marking thermometers (*q.v.*) so called from the inventor, *G. D. Fahrenheit*. Its freezing-point is 32°, and boiling-point 212°. This thermometer is in common use in England and in the United States.

Faith=Cure. A system in which it is claimed that the sick can be cured without medicine, needing only faith in certain persons or objects to produce this effect. Christian Science and some other systems seem based on a similar principle.

Fal'con. [*L. falx*, a reaping-hook.] A bird of prey with claws like a hook. This bird used to be trained to catch other birds for hunters. Eagles, buzzards, and hawks, and most birds of prey, belong to the class of Falcons. All have the same tearing beak—a tooth-like lobe on the upper mandible—and all the same hooked claws. They lay from two to four eggs in the year. The peregrine falcon or hawking falcon is a trim, brave bird. Hawking with the falcon is still practiced in Persia and India. The gyrfalcon is an Arctic bird.

Fall'ing Stars. The flashing meteors which dart across the sky at night and quickly disappear. At certain periods of the year they are seen in large numbers, and yield the impression of stars falling from their place in the heavens.

Fal'low Deer. [*AS.*] A deer of a fallow or pale yellowish-brown color, smaller than the red deer. In summer both sexes are spotted with white. It is a native of Persia, but is now domesticated in Europe.

Fan. [*AS.*, from *L.*] An instrument for blowing away chaff, or for moving the air to cause coolness, or to blow a fire. Ladies' French fans are made of ivory, mother-of-pearl, tortoise-shell, bone, gauze, or feathers. Cheap fans from India and China are palm leaves or split bamboo. Large machine fans, moved by steam power, are used for many purposes, and electric fans to cool large rooms in summer.

Fari'na. [*L. farina*, meal.] Ground corn or fine meal made from cereal grains or from the starch extracted from vegetables, and used in cookery. —*Farinaceous food*, food consisting of meal or flour.

Fat. [*AS.*] The soft, oily part of an animal's body. Carbonaceous foods act both to yield animal heat and to form fat, which is of use to the animal in protecting it from the cold and forming a store of food. Some fats are *solid* at ordinary temperatures. These include beef suet from the ox, mutton suet from the sheep, lard from the pig, butter from milk, dripping (melted fat from meat). They become liquid when heated, and are chiefly composed of stearin. Liquid fats are commonly called oils, and include olive oil, cod-liver oil, etc. Oils (*q.v.*) are composed of olein, and contain less hydrogen than solid fats. Fat is lighter than water, and is insoluble in water. Benzole or benzene will dissolve fat, and is much used to remove grease spots from clothing.

Fea'ther. [*AS.*] A stalk of horn, hollow at the lower end or quill and filled with pith, and fringed at the other end, forming part of a bird's wing or the covering of its body. Birds are the only animals that are clothed with feathers, and much of their beauty is due to the colors and markings of the feathers. Feathers grow from little sacs in the skin, and are horny and of much the same substance as the scales of reptiles. Soft downy feathers, which overlap one another, form the warm covering of the body. The large quill feathers of the tail and wings are useful for flying. On each side of the quill are barbs, which, cleaving closely to their neighbors by hooks or barbules, make up the web or vane. Lower barbs of a feather and downy feathers have no hooks

on them. The tail feathers of the ostrich and other such birds also have no hooks. Birds always preen or trim their feathers with oil taken from an oil-gland at the end of the tail. This oil is most abundant in water-birds, and makes their feathers waterproof. Partridges and



FEATHERS.

a, *d* shaft ; *b*, aftershaft ; *c*, barbs or web.

scratching birds have dingy feathers like the ground on which they live; pheasants and brilliantly-colored birds blend with the bright flowers and pretty fruits upon which they feed. The feathers of various birds form an important article of commerce. Feathers are useful as articles of trimming and ornament, and for the stuffing of beds and pillows. The quills of feathers were formerly made into pens, but the extensive manufacture of steel pens has supplied their place. Feathers for ornament are obtained from the ostrich, marabout, peacock, pheasant, bird of paradise, heron, osprey, and other birds.

Felt. [O.E.] Cloth made of the shortest fibres of wool, or of wool and fur of hares and rabbits, not woven but mixed with thin glue, and rolled or pressed together. After being switched up into fluff by *bowing*, it is carded and twisted into a soft, loose cloth, which is wound on a roller and carried to a felting machine, and then dyed. Fine felt is used for hats and coarser felt for table cloths, carpets, roofing, lining buildings to prevent dampness, and many other purposes.

Fermenta'tion. [L. *fermentatio*.] A change which many organic liquids are capable of undergoing in the presence of certain substances termed *ferments*. The decompositions which take place are different from ordinary chemical actions, and the resulting products vary with the

nature of the fermented body and with the kind of ferment used. There are two distinct kinds of ferments—(1) *organized*, and (2) *non-organized*, or soluble ferments. The former consist of minute vegetable organisms. One is yeast, which gives rise to the alcoholic fermentation, producing chiefly alcohol and carbonic acid; another, called bacterium lactis—a rod-like form—is the cause of the fermentation in milk, or lactic fermentation, the chief product of which is lactic acid; a third produces acetous fermentation, giving rise to acetic acid, and there are many others.

Fern. [AS.] An order of plants belonging to the class of *acrogens*. They are usually found in moist soil, sometimes they grow as parasites on trees, and in the tropics reach so large a size as to be called tree ferns. The brake or bracken, polypody, asplenium, maidenhair, are all well-known ferns. They bear clustered cells filled with spores, which germinate and form minute growths, on which are borne the true organs of reproduction. These spores are generally produced in rows on the back of the leaves, or *fronds*, as they are usually called; or sometimes on a central branch or spike. There are more than two thousand kinds of ferns in the world.

Fer'et. [Fr.] An animal of the weasel kind, about 14 inches long, used for hunting rats and rabbits out of their holes. It is like the weasel in form, has red eyes, and its fur is of a light brown, pale yellow, or white color. When used for rabbit-hunting its muzzle or jaws are tied together; and as it cannot bite the rabbits, they are driven to the entrance of their burrows, where they are netted or shot. The ferret in winter must be protected from the cold. It is a native of Africa, but has been domesticated in Europe.

Fe'ver. [Fr.] An illness causing great heat in the body and quick action of the heart. Remittent fevers subside at intervals; intermittent fevers entirely cease at intervals; continued fevers neither abate nor intermit.

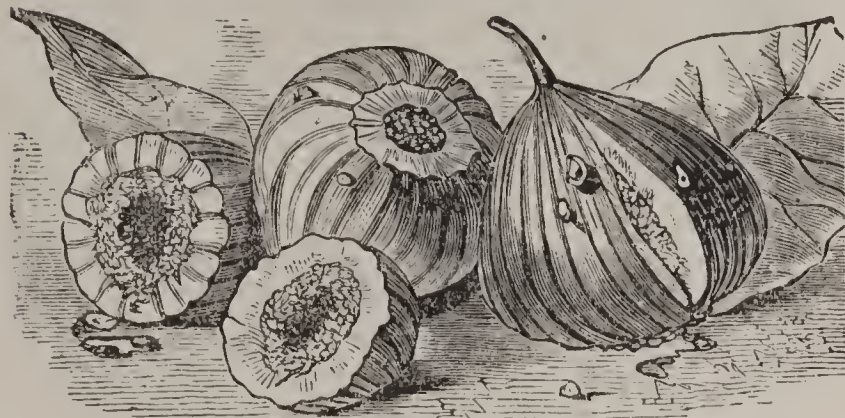
Fi'bre. [Fr., from L. *fibra*, a thread.] The thread-like parts in the flesh of animals; also those in the stalks of such plants as hemp, flax, agave, jute, cotton, etc., from which thread, string, rope, and paper are made; also the hairs and wool of animals, the thread of the silkworm, and other substances used in weaving, etc.

Fi'brin. A substance which separates in a solid state from blood after it leaves the body. It is a white, stringy substance, which may be readily obtained by stirring newly-shed blood. It is tasteless, insoluble in water, but is readily digestible in gastric and pancreatic juice, and when dried forms a heavy mass resembling albumen.

File. A small wind instrument used with the drum for military music. It is a short tube closed at one end, with holes in the side. It is very ancient, having been used by the old Greeks,

Fig. [Fr., from L. *figus*, a fig-tree.] A small fruit-tree of from 12 to 20 feet high, with large leaves. The fig is a native of Syria, and grows wild on the Mediterranean coast. It bears two crops annually, and when the fruit is picked it is spread out to dry. Fig-cake is used in the East instead of bread.

File. [AS.] A piece of steel made rough for smoothing wood or metal. A file differs from a rasp in having the furrows made by straight cuts of a chisel, either single or crossed, while the



FIGS.

rasp has coarse single teeth. There are many shapes — flat, square, knife-edged, half-round, rat-tail or round, three-square, cross, and slitting.

Fil'igree. [Span.] Fine thread-like work of arabesque pattern, made of gold or silver wire or wire used in decorating gold or silver. It is made mostly in India, Turkey, Italy, and Malta.

Fil'ter. [From root of *Felt*.] Any substance, as charcoal, sand, or felt, through which liquid passes, and by which it is cleared of foreign substances. Filters are much used for obtaining pure drinking water, and are employed on a large scale in purifying the water-supply of cities.

Fine Arts. The arts designed to appeal to the artistic taste and give pleasure to observers, as distinguished from the useful arts, designed to benefit mankind. They are usually restricted to the arts of painting, sculpture, and architecture.

Fins. [AS., from root of *L. penna*, a feather.] The parts of a fish by which it balances itself and moves forward in the water. The paired fins on the opposite sides of the body are the true limbs of the fish. Those near the gills behind the head are the pectoral fins, and represent the fore limbs of quadrupeds; those below are the ventral fins, and represent the hind limbs; those on the back are dorsal or first and second dorsal; those underneath near the tail are the anal fins, and the tail itself is the caudal fin. These are used as its means of motion and the tail also serves as a rudder.

Finch. [AS.] The name of a family of song-birds, as chaffinch, goldfinch, bullfinch. Many of the finches are beautiful singers, and others are prized for their delicate flesh. They frequent fields, groves, hedgerows, etc., and feed chiefly on grain and seeds. The common sparrow, an European bird now abundant in the United States, is the true type of the Finch tribe.

Fir. [AS.] The name of several kinds of coniferous trees, producing valuable timber or resin. Firs, such as the balsam fir, the silver fir, and the red fir, are large in size and elegant in shape, and belong to the genus *Abies*. The silver fir on the Pacific coast grows to a height of 200 feet.

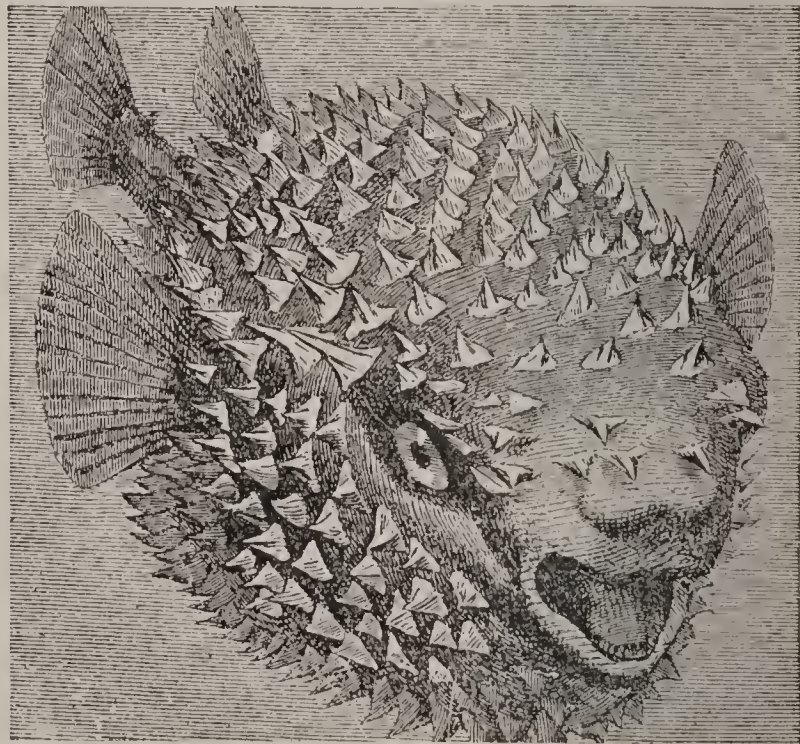
Fire-engine. A machine by means of which water can be thrown to a great height for the purpose of extinguishing fires. The principle of

its action is the same as that of the force-pump (*q.v.*); but in a force-pump the stream of water is intermittent, flowing only at each descent of the piston. This is obviated in the fire-engine by employing a strong air-vessel, into which the water is forced, the compressed air reacting on the water so as to keep up a steady flow. In the force-pump there is only one cylinder, but in the fire-engine there are two, in which the pistons are worked simultaneously, one ascending while the other descends. Fire-engines were formerly worked by hand, but now steam fire-engines are widely employed.

Fire-fly. A small insect which gives out a bright light in the dark. All glowworms are called fire-flies or firebeetles, but the American firefly, which generally sparkles in humid districts, is called *Photinus*, and both sexes are winged.

Fire-works. Preparations of gunpowder, sulphur, metallic filings, and salts, to be set on fire. The most common form of firework is a pasteboard tube filled with these explosive materials. A number of these tubes are often arranged so as to make, when kindled, a great variety of figures in fire variously colored. Stars are made of nitrate of strontia and gunpowder. Rockets are used in war and as ship signals, as well as in pyrotechnic displays. The life-saving rocket consists of a drawn steel tube with a composition that expels the gases with a pressure of 60 tons to the square inch. It is used to carry a rope to a wrecked vessel near the coast.

Fish. [AS.] A vertebrate animal covered with scales that lives almost entirely in water, has no lungs, and breathes through gills. It lays eggs, and, having a heart with only two chambers, its



THE GLOBE FISH.

blood is cold or of the temperature of the air. All the seas and rivers abound in fish. The true fishes include the *teleostei*, or ordinary bony fishes; the *Ganoidei*, as the sturgeon; the *Dipnoi*, or air-breathing fish, of which there are a few species; the *Selachians*, or sharks and skates. Fishes are usually covered with scales

(*q.v.*), which overlap each other, and are moistened with a kind of slime. Many of them are of beautiful colors—gold, silver, and copper tints, and attractive shades of blue, green, red, and black. Fishes swim chiefly with the tail, and their fins (*q.v.*) help them to keep their upright position in the water. They are rich in nitrogenous material, chiefly albumen and fibrin. Some fishes—as salmon, herring, mackerel, and eels—also contain much oily matter, which makes them not so digestible as whiting, sole, etc. Among the fishes most useful as food for man are the cod, salmon, mackerel, pilchard, and herring.

Fish-culture. A method now widely adopted of planting the eggs of fish and guarding the young against their enemies. In this way many millions of young fish are raised and placed in the streams annually. The United States Fish Commission thus distributes over 250,000,000 young fish every year. The same principle is also applied to the lobster, the oyster, and other food animals.

Fish-hawk. The American fishhawk or osprey is found over nearly the whole country. It is a large bird, looking much like the eagle, some of them measuring over five feet across the wings. It lives on fish, darting into the water to seize them. It is often robbed by the bald eagle, which forces it to drop the fish and then swoops down and seizes it in its fall.

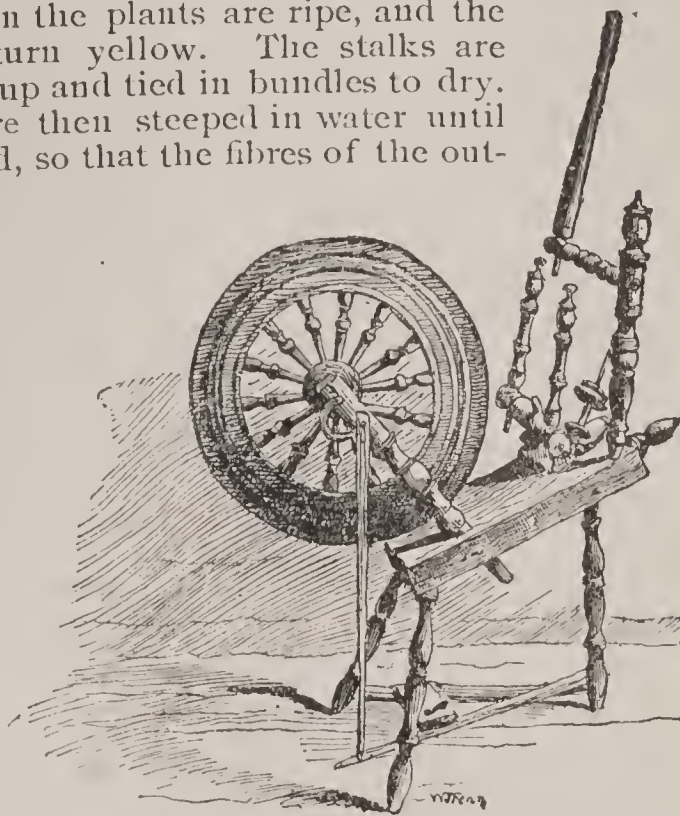
Flag. [*Scand. to hang loosely.*] That which flies or flutters loosely in the wind, but more especially a banner bearing a device or devices, and used to indicate nationality or to give information. *Flag of truce* is a white flag exhibited to an enemy to invite a conference. *Yellow flag* is the quarantine flag, and at the fore of a ship indicates that infectious disease is on board.

Flame. [*Fr., from L.*] The illumination given by burning gas. Heat is produced by the chemical action which takes place during combustion, the temperature of the burning material being raised sufficiently high to give out light or to produce flame. The structure of flame can be most easily observed in a candle, lamp, or ordinary gas flame. When a gas flame is lit, it is seen that the part nearest to the burner is only feebly luminous. This consists of the gas which has just escaped from the pipe, and, though to some extent heated, has not begun to unite with the oxygen of the air. As the gas rises higher, it comes into contact with oxygen and unites with it. At first the hydrogen of the gas unites more rapidly with oxygen than the carbon, and in consequence a number of particles of carbon are set free, which, on becoming intensely heated, give rise to a bright flame. The illuminating power of the flame is due to the particles of glowing carbon, which, as they rise higher, are consumed on the border of the flame in contact with the atmosphere. In order to give out much light, a flame should contain solid matter; but the most luminous flames are not necessarily the hottest.

Flamin'go. A wading-bird of several species. It is of a brilliant red, and has a long neck and legs. In feeding, the head is bent downward and

inward so as to reverse the position of the upper mandible. The nest is made of mud scratched up two or three feet high, and two eggs are hatched, the bird standing so as to rest on the tall nest. The red flamingo posts sentinels, which give warning of danger with trumpet notes.

Flax. [*AS.*] A plant about two or three feet in height, with small pointed leaves and blue flowers. The stems are hollow, and covered with fibrous material. The flowers grow in clusters at the top of the stalks, and are succeeded by round seed-vessels the size of a pea. Each seed vessel contains ten flat seeds of a brown color. It thrives in a rich, moist soil. The leaves drop off when the plants are ripe, and the stems turn yellow. The stalks are pulled up and tied in bundles to dry. They are then steeped in water until softened, so that the fibres of the out-



FLAX-WHEEL.

side covering or bark can be separated. The fibre of flax is spun and woven by machinery into linen, and then bleached by chloride of lime. Flax is grown in Europe and the United States, where it was introduced from England in 1629. Linen, lawn, and damask cloth are woven from flax-thread, and linseed oil is made from its seeds.

Flea. [*AS.*] A small insect without wings that moves by leaping, and whose bite is troublesome because slightly poisonous. The human-flea is abundant in Europe, but rare in America, where the dog-flea takes its place. The dog-flea infests dogs and cats, and is occasionally troublesome to man.

Flints. [*AS., a hard stone.*] Amorphous lumps of dark silica which occur in nodular sheets in chalk and other limestones. They often enclose such organisms as shells and sea-urchins; spicules of sponges abound in flint. The process by which flint has been formed is uncertain; but it is supposed to be due either to the abstraction of silica from sea-water by sponges, or to the decomposition of animal remains. *Flint-glass* is dispersive of light, and consists of silicate of lead and potassium. It is used for table-ware, and prisms, and is called crystal glass.

Floun'der. [Du.] A flat fish found near the mouths of rivers. There are many different kinds both in Europe and America.

Flour. [Fr., from L. *flos*, flower.] The finest part of meal or corn ground into fine powder. In milling, meal is separated into flour and bran, the meal being afterwards separated from the bran by *bolting* through a gauze-covered revolving cylinder. There are various kinds of flour, some fine, others coarse, and of different grains, as wheat, rye, etc.

Flow'er. [Fr., from L. *flos*, flower.] The part of a plant destined to produce seed. The flower is easily seen in such plants as the rose and the buttercup in which it is large and brightly colored; but grasses, too, and indeed all plants of a higher order have well developed flowers. In a buttercup, on the outside of each flower, are small greenish-yellow *sepals*, five in number, which form the *calyx*. Then come five large bright-yellow *petals*, forming what is called the *corolla*. Inside this, looking like little pins with yellow heads, are the *stamens*. In the centre of the flower are some green bodies called *carpels*, which together form the portion of the flower called the *pistil*. Every part of the flower has its use. The calyx protected the flower when it was a bud. The corolla attracts the insect to the flower. The stamens form pollen, which when placed on the pistil causes the carpels to swell and form seeds. The pollen is carried from the stamen of one flower to the pistil of another by insects. Flowers also contain nectar. It is the wind which carries the pollen of grasses and several other plants. (See *Fruit*.)

Fluid. [Fr., from L. *fluidus*, flowing.] A substance whose particles possess perfect freedom of motion among themselves, so that any force applied to it will, if not resisted, produce a change of shape. There are two classes of fluids—*liquids* and *gases*—and each class has some properties peculiar to itself.

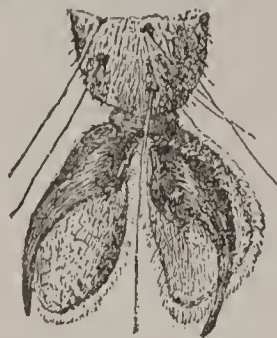
Fluo'rine. [L.] A non-metallic element, never met with in nature in the uncombined state. It is the only element which does not combine with oxygen. It is most frequently found combined with calcium in the mineral fluor-spar. In minute proportions it is widely diffused in the waters of some springs, rivers, and the sea, and in the bones of animals. Combined with hydrogen it is used in etching glass.

Flu'or-spar. A mineral found in veins, very often accompanying lead ore. It occurs both crystallized and massive. The crystals belong to the cubic system, and are either colorless, green, purple, or yellow. When heated it becomes phosphorescent. It is used as a flux, and some varieties are employed for ornamental vessels.

Flute, [Fr., from L. *flare*, to blow.] A light wind-instrument played by the mouth on a lateral hole, and by the fingers, which stop holes along its length or open keys.

Fly. [AS.] A name applied to many of the winged insects, but scientifically restricted to the sub-order *Diptera*, which have two wings and whose mouth-parts are converted into a sucker, used for

taking up fluids. The sucker acts as a lancet, by which the skin of animals and vegetables is pierced so as to reach the blood or sap. The flies comprise many thousands of species, differing greatly in size, the best known being the common house-fly.



FLY'S FOOT MAGNIFIED.

Flying-fish. A fish that can leap into the air with a spring of its tail, and keep itself up by its fins for a time as if flying. Its pectoral fins are developed so as to act like wings. It can fly for hundreds of yards, and is frequently attacked by sea-birds and dolphins (*q.v.*). It has a bladder that can be inflated to fill the whole cavity of the abdomen; it has also a membrane that is inflated through the gills. The California flying-fish is said to fly for nearly a quarter of a mile, usually not rising more than four feet. There are several kinds, which are found in tropical seas.

Fly-wheel. A contrivance for regulating the driving power of a machine. In the steam-engine the power of the connecting rod to turn the crank varies with their relative position. When the rod is at right angles to the crank its turning effect is greatest, and when they are in the same straight line this power is *nil*. There is thus introduced a cause of unevenness in the motion through the whole length of the stroke. To obviate this difficulty the *fly-wheel* is fixed on the axis. This is a large wheel with a heavy rim, which, when once started, requires little work to keep it in motion; but, since it possesses much energy in consequence of its motion, it acts to make uniform the motion of the rod and crank.

Fog. [Celt.] When the vapor in the air reaches the point of saturation (see *Dew*) it condenses, and assumes the form of very small drops, which constitute *fog* if they are present in the lower regions of the atmosphere, and *cloud* if in the higher. Fogs are therefore of the same nature as clouds (*q.v.*). Fogs may be caused by the flow of a current of warm moist air over masses of ice, such as are sometimes encountered in the Atlantic, and are often seen on the Banks of Newfoundland.

Fog Signals. Signals to prevent the collision of vessels in foggy weather. Many methods of signalling have been tried, the best being the whistle and the trumpet. The most powerful is the siren trumpet, whose sound can be heard for more than 20 miles.

Folk-lore. The study of ancient legends, rustic tales, superstitions, etc. This term has been used since 1846, and great collections of the beliefs, customs, and popular tales handed down from the far past have been made.

Food. [AS.] All substances used for purposes of nutrition. The useful constituents of all foods—animal, vegetable, and mineral—are classified as (1) nitrogenous, including the animal and vegetable albuminoids and gelatin; (2) fatty, including animal and vegetable fats and oils; (3) carbohydrates, including starch and the sugars; (4) salts

organic and inorganic; (5) water. In addition to the vegetable and animal foods consumed for the support and growth of the body, there are also needed lime, iron, soda, potash, chlorides and phosphates, etc. Water is very necessary, since it forms two-thirds of the weight of the body. A very great variety of foods and combinations of nutritive materials are used by man.

Fools' cap. A size of paper 16 by 13, which used to have as its water-mark a *fool's cap and bells*.

Foot. [AS.] That part of the body on which animals stand and walk. There are 26 bones in the foot and ankles of man. To these are fastened a great number of ligaments and muscles, by which their movements are guided and varied. The foot of the chimpanzee is in many points like that of man, but the toes are longer, and it is not adapted for easy standing or walking. The feet of quadrupeds differ greatly. Some have five toes like man, some four or three, and in many cases—as in the oxen, deer, antelopes, camels, and others—there are only two toes, covered with horny

hoofs. The horse has but one toe, covered with a strong hoof, which is really the nail greatly developed. What is called the knee

in four-footed animals is usually the heel, lifted above the ground. Some animals walk, like man, on the flat sole of the foot; some, like lions and cats, on the bent toes; others, like the horse and ox, on the tip of the toe, which is covered by the hoof. Birds have usually four toes, three in front and one behind, the foot and toes differing as they are intended for perching, walking, wading, or swimming.

Football. A game of kicking a ball with the foot between goals. The ball is usually made of India-rubber or a bladder, and is enclosed in a leather cover.

Foot-rule. A measure of a foot, or 12 inches, in length. It differs in length in different countries. In Britain and the United States it is .3048 metre.

Force-pump. A pump having a solid piston for drawing or forcing liquids like water through the valves. The force-pump delivers the water a considerable height above the pump. It is useful in draining cellars or low level places, and in fire-engines.

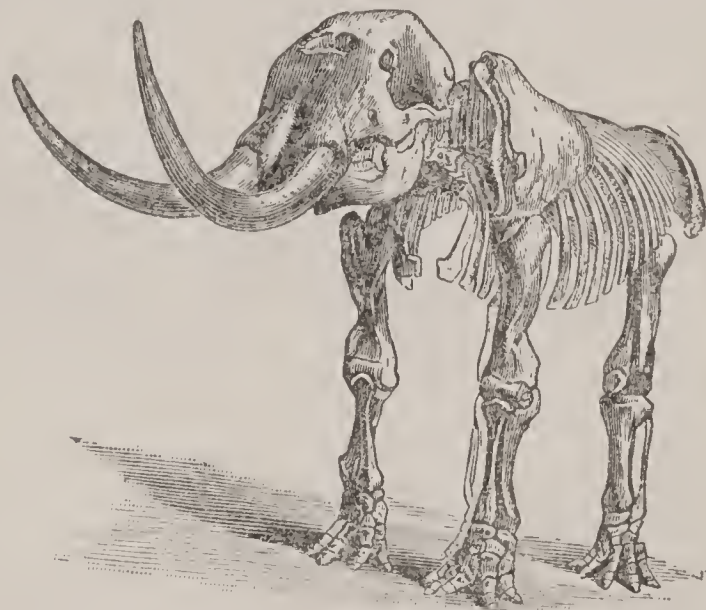
Fore'castle. [Pronounced by sailors *foksl.*] An upper deck before the foremast in a war-ship, which formerly had a turret near the prow or the front part of the ships where are the sailors' berths.

For'est. [Fr., from L. *foris*, out of doors.] A large piece of country covered with trees, or an unenclosed, uncultivated land on which wild animals are hunted. Forest-tree is a tree of the forest, grown for its timber, as distinguished from a fruit-tree.

Forge. [Fr.] The furnace in which a smith heats the iron to be hammered. A portable forge is a light and compact blacksmith's forge, with bellows, etc., that may be moved from place to place. In large forges steam-hammers are used, and the metal is moved by cranes.

Forget'=me-not. A small plant of the genus *Myosotis*, with blue flowers, used as a sign of friendship and fidelity.

For'mic Acid. [L. *formica*, ant.] A sharp acid occurring naturally in ants, nettles, etc., and



AMERICAN MASTODON, FOSSIL.

produced artificially in several ways. It is the first member of the fatty acids in the paraffin series, and is similar in character to acetic acid.

Fort. [Fr., from L. *fortis*, strong.] A stronghold. Usually a small fortified place, occupied by troops, and surrounded with a ditch, rampart, and parapet, or with palisades or stockades.

Fos'ilized Trees. In many localities collections of tree trunks converted into stone have been found. There are several of these in the United States, there being a remarkable ancient forest in Arizona, whose trees have been converted into opal or agate, with beautifully variegated colors. Some of them are six feet in diameter.

Fos'sils. [Fr., from *L. fossus*, dug.] Hardened remains of animals or plants found in rocks which have been dug out of the earth. Most fossils belong to extinct species, but many of the later ones belong to species still living. The geological strata comprise three main divisions:—the Primary, the Secondary, and the Tertiary; each of these including a number of minor divisions. In the Primary division we find corals, crustaceans, molluscs, fishes, and a few reptiles, and also an abundant flora of herbs and trees of the lower orders, found in the Carboniferous period. The Secondary age had its herbs and plants, its corals, its crustaceans, its molluscs, and its fishes; but the leading animals of this age were its huge reptiles of sea and land. It was peculiarly an age of egg-bearing animals, winged and wingless. The first birds now appeared, with teeth in their jaws, also small marsupial mammals. In the Tertiary period the mammals were wonderfully developed in size and numbers. Its mammoths and its mastodons, its rhinoceri and hippopotami, its enormous dinotherium and colossal megatherium were much larger and more numerous than the largest of existing mammals. The fossil remains of one of its elephants are still so abundant amid the frozen wastes of Siberia, that what have been not inappropriately termed "ivory quarries" have been wrought amid their bones for more than a hundred years. The western section of the United States is exceedingly rich in fossils of the Secondary and Tertiary periods, and new forms are found there annually, some of them of huge dimensions.

Fowl. [AS.] A farm-yard bird used as food, as cock or hen, turkey or duck. Hens feed on grain and seeds, and also worms, flies and beetles. Farm-yard cocks and hens are a mixture of breeds. Game fowls are smaller, and have more delicate legs. Dorkings were first raised at Dorking, England, and are large birds and good layers. Spanish birds are large, with glossy black feathers. Cochin Chinas are clumsy in shape, and usually reddish-brown, white, gray, or silver gray. Black-breasted Malays and Shanghais are large birds. Hamburgs or grays are silvery white and black speckled. Bantams are very small and courageous. Black and white Houdans are French fowls, and white Leghorns are Italian. The points of a fowl are the neck and saddle hackles, the wing coverts, tail, comb, earlobe, wattles, breast, thighs, and legs.

Fox. [AS.] A carnivorous wild animal belonging to the Dog tribe, famous for its cunning. It has a fine coat of reddish-brown fur, low forehead, ears pointed, and wide at the base, and a splendid bushy tail of the same color, tipped, like its breast, with white. The fox is very mischievous, and usually lives in holes on the borders of a farm, which it visits by night. Its food is poultry, game, rabbits, but also frogs, mice, and insects. It is fond of berries and fruits, grapes and honey. Fox-hunting is a popular sport in Britain, fox-hounds being kept to scent and chase the animal, which leaves a strong odor. It tries to deceive the dogs, and passes over a

marsh, or through a thicket, or jumps up a fence or tree, to break the scent. The skin of the fox is very useful; that of the Arctic fox being much valued. This animal changes the color of its skin several times during the year, and in winter is white. The skin of the silver or black fox of North America is most valuable. The common foxes of Europe and America are very similar. Fox-brush is the tail of a fox. Fox-terrier is one of a peculiar breed of terriers, used in hunting to drive foxes from their holes. There are rough and smooth haired varieties.

Fox'-glove. [AS.] A large plant with beautiful



purple or white bell-like flowers, spotted inside. The common European plant is a handsome perennial or biennial, whose leaves are so useful in medicine, chiefly as a sedative in heart disease.

Franc. [Fr.] A coin used in France worth a little less than 20 cents. It has been used as the

unit of French coinage since 1795. It is divided into one hundred centimes.

Freez'ing Mixture. When a substance changes from the solid to the liquid, or from the liquid to the gaseous state, heat is required to effect the change; and when heat is not supplied from without to produce the change, the body itself, and everything in contact with it, becomes colder. This is the principle of freezing mixtures. When ice and salt are mixed, the salt (from its tendency to absorb and dissolve in water) will cause the ice to melt. But ice in melting uses up a large quantity of heat, and the result is (since the heat has in this case been withdrawn from the substances themselves) that the mixture is rendered very cold, and water poured into a test-tube and placed in it will freeze. In practice, freezing mixtures are used for producing artificial ice in moderate quantities, and in freezing creams, etc.

Freez'ing-point. That degree of a thermometer at which a fluid begins to freeze. Applied to water, the freezing-point is 32° F. and zero or 0° C. Mercury freezes at 39° F. below zero.

Fret'work. Work adorned with figures cut out by a fine saw. Fillets intersecting each other at right angles are classic designs, and those at

oblique angles are often based on Oriental art. Fret-saw or scroll-saw has a long, narrow blade.

Fric'tion. [L.] The rubbing of one body against another. It may be caused by a sliding motion or a rolling motion. Friction clutch or coupling is an engaging or disengaging gear for revolving shafts, pulleys, etc.; they being so pressed together as to revolve in company. Friction-wheel transmits motion by surface friction instead of by teeth.

Frieze. [Fr.] Coarse woollen cloth with a nap on one side, used for outer garments; also the flat band between the cornice and the architrave of a pillar, usually covered with carving.

Frig'ate. A ship of war having two gun-decks, and carrying from 20 to 50 guns; classed between a sloop-of-war and a line-of-battle ship. The term frigate has nearly disappeared, being replaced by *cruiser* in naval terminology.

Frig'ate Bird. [Fr.] A web-footed bird, called also man-of-war bird or frigate-pelican. Its beak and wings are long, and its power of flying very great. It feeds on fish, which it takes from gulls, terns, and other birds.

Fringe. [Fr.] A border or edge of loose threads of wool, silk, or linen; originally consisting of the ends of the warp projecting beyond the woven fabric, but now made separately and sewed on.

Frog. [AS.] A small vertebrate animal, with a broad, squat body without a tail, that lives both on land and water. It has a smooth, slimy skin of a greenish-brown or reddish color; it has teeth on the upper jaw, and by this is distinguished from the toad, which has no teeth. Its tongue is soft and fleshy, and fixed on the front of the mouth, but free behind, so that it can roll out and catch an insect. The tip of the tongue is always covered with a treacly, glutinous matter, to which any insect caught adheres. The frog flings its food down its throat with a very rapid motion. As with the rabbit, its fore limbs are less used than the hind limbs, and so are shorter and smaller. The hind legs are long, and support the swimming web. It has four fingers in front and five toes behind. Frogs breathe slowly, and their blood is of a low temperature. The food of frogs is insects, snails, worms, and they swallow their food whole. Frogs cannot breathe in water, and so live much on land; but water is needed to keep their bodies moist. They lay their eggs at the bottom of the water. The eggs are laid in a kind of jelly, which fastens them to a stick or plant in the water. After about a month the eggs hatch, when there appear small tadpoles, with head and tail and a pair of shoulders behind the mouth, and with gills for breathing. As they grow the gills and tails are lost and the frog develops. Of frogs, the tree-frog, the pond-frog, and the bull-frog are the most familiar. Frogs are found all over the world, and are eaten as food in many places.

Frost. [AS.] When the temperature falls below 32° F., all superficial moisture changes into ice, and we have frost. Frost is one of the agents which play an important part in moulding the

surface of the land, as it causes rocks to decay, and breaks up the materials of the soil. When rain falls it sinks into the pores of rocks, and soaks into the soil; and this moisture, in changing into ice, expands and pushes the particles of the rocks or of the soil more widely apart. Ten cubic feet of water give 11 cubic feet of ice. When a thaw sets in, the surface of the rock is loosened, and crumbles into soil, or is washed away by rivers to the sea, and the materials of the soil are broken up and rendered more fit to be made use of by plants. Black frost is where the cold turns vegetation black without hoar or white-frost.

Fruit. [Fr., from L. *fructus*.] The matured seed vessel and its contents. Thus the ears are the fruit of the corn plant, nuts are the fruit of the hazel tree, pods the fruit of the bean or pea, and the



THE BANANA.

acorn the fruit of the oak. In the apple, orange, etc., the seeds are imbedded in a soft, juicy, fleshy substance; in dry fruits, such as nuts, the seed or kernel is surrounded by a hard shell; in drupaceous or stone fruit, as peaches, the fruits are stony within and fleshy without. *Small fruits* include currants, gooseberries, raspberries, strawberries, etc.

Fun'gus. [L.] An order of soft plants, including truffles, toadstools, and mushrooms. More particularly the growth on an animal or plant caused by decay or disease, as mildew. Some kinds of fungi are used for food. Lichens are now believed to be fungi existing as partners with algæ.

Fur. [Fr.] The fine hairy covering of certain animals found in cold regions. In the hairy covering of the cat two kinds of hair grow—one short, soft, silky, and barbed lengthwise, which is the *fur*; and longer smooth hair, which is called the *overhair*. The best-known fur-bearing

animals are the seal, beaver, sable, fox, mink, marten, otter, ermine, and musk-rat. After the skins have been removed from the animals, and before they are cleaned, they are called pelts. Fur forms the chief clothing of the inhabitants of Arctic regions, and in temperate regions is also used for trimmings or for outdoor garments. In seal-skins for ladies' jackets the overhair is usually removed. The furs of the rabbit, hare, and beaver are used to make felt.

Fur'nace. [Fr., from L. *fornax*, oven.] A close fireplace for melting metals, baking bricks, etc. In air or wind furnaces the fire is urged by the natural draught; in a blast-furnace a forcible current of air is thrown into the fire; in a reverberating furnace the flame, in passing to the chimney, is thrown down by a low arched roof on the materials in the furnace.

Fur'niture. [Fr.] Things supplied or needed for any purpose, as sails, tools, and fittings, and more particularly the articles needed to fit a

house for being lived in. Certain articles, as kitchen-ranges, cupboards, shelves, and blinds are called fixtures. In printing, the furniture consists of pieces of wood or metal, lower than the type, placed round the pages or form to secure the type in its place.

Fuse or Fusee'. [L. *fusus*, poured.] A tube filled with explosives, used for firing mines, etc. Fusee also means a match for lighting a pipe or cigar.

Fusee'. [L. *fusus*, spindle.] The cone-like wheel in a watch for the chain to be rolled on, in such a manner that the diameter of the wheel at the point where the chain acts may correspond with the degree of tension of the mainspring.

Fu'sel-oil. [Ger.] An acid volatile oil obtained in the manufacture of potato brandy and whiskey. Its chief constituent is amyl alcohol. It has a powerful and suffocating odor, and is supposed to be a product of the fermentation of sugar. It is an undesirable ingredient in alcohol.

G

Gad'fly. [O.E. *gad*, sting.] An insect that deposits its young in the nostrils of sheep; a species infests cattle, depositing its eggs on the skin and causing sores; another kind produces intestinal parasites in horses.

Gai'ter. [Fr.] A covering of cloth or leather for the ankle and the instep, or for the leg from the knee to the instep, fitting down on the boot or shoe.

Gal'axy. The Milky Way, or zone of milky light which is seen in the sky on clear nights, and is made up of millions of stars. The term is also used for any assemblage of splendid things or persons, as a *galaxy* of beauty.

Gale'na [L.], or **Sulphide of Lead**, occurs native, and constitutes the chief ore from which most of the lead of commerce is obtained. (See *Lead*.) It possesses a bright bluish-white metallic lustre. It is sometimes found in Transition rocks, but more frequently in the Secondary rocks, especially in compact limestone. It occurs in beds and veins, and is found in almost every country. It is very abundant in Britain and in the United States. It is prepared artificially by adding sulphuric acid to a soluble lead salt.

Gall. [AS.] A fluid of a greenish-yellow color, and very bitter, found in the gall-bladder beneath the liver, and consisting of bile mixed with the secretion of the mucous membrane of the gall-bladder.

Gall-nuts. Nuts produced by small insects which puncture the bark of the Lusitanian oak in Southern Europe and Western Asia, and lay their eggs in the wounds. They contain much tannin and are used in making tannin, ink, dye, and in medicine. Oak-apples are formed on other oaks in the same way.

Gal'lon. [Fr.] The standard unit of cubic measurement. The British gallon contains 277.274 cubic inches, and a gallon of distilled water weighs 10 lbs. (avoir.). The gallon of the

United States is the standard Winchester wine gallon of 231 cubic inches. The New York State gallon contains 221.184 cubic inches, or 8 pounds of pure water.

Galvan'ic Battery. [Ital., from *Galvani*, the discoverer in 1791.] It consists of a number of zinc and copper plates connected together, their purpose being the production of a current of electricity. These are arranged in cells, the copper-plate of one being joined to the zinc-plate of the next, and the final copper connected by a wire to the zinc of the first cell. The cells contain a dilute acid, which acts chemically on the metals, and generates an electric current which flows around the circuit of cells and wires. The connecting wire may be many miles in length, as in a telegraph line. The zinc of the first cell is called the negative *electrode* and the copper of the last cell the positive *electrode*, the current being supposed to flow from positive to negative. There are many varieties of galvanic batteries in use, and other metals than copper and zinc are employed. Formerly all electric currents were produced by the battery; now it is used only for weak currents, powerful currents being produced by the *dynamo* (*q.v.*) (See *Electricity*.)

Gal'vanized Iron. The name given to sheets of iron which have been coated with zinc. True galvanized iron is first coated with tin by a galvanic process, and afterwards with zinc by immersing it in a bath of melted zinc containing sal ammoniac mixed with mineral matter.

Galvanom'eter. An instrument for measuring the strength of an electric current by means of the deflection which it produces in a magnetized needle. The galvanometer is constructed by using a coil of insulated copper wire, in the centre of which is suspended the magnetized needle. It is frequently named the *multiplier*.

Gamboge'. [*Cambodia*, in Asia.] A reddish-yellow gum used for coloring and in medicine.

It is got from several trees in Siam, Malabar, and Ceylon. It is brought in masses from Cambodia. The best kind is of a dense, compact texture. The gamboge tree of Western India yields, in addition to gamboge, a kind of oil called gamboge butter.

Game. [AS.] Sport of any kind; animals kept or hunted for sport. In Europe game includes grouse, black game, pheasants, partridges, and hares, ptarmigans, quails and larger game as the moose and wild boar. In the United States game includes a great variety of animals. These are rarely kept in enclosures for sport, as in Britain, but they are protected from indiscriminate slaughter by game laws, confining hunters to fixed seasons and means of capture.

Games. [AS., *games*, joy, pleasure.] A term applied to certain physical exercises and mental recreations, distinguished as *games of chance* and *games of skill*. The physical games are such as cricket, football, billiards, golf, etc., the mental are card games, chess, draughts, backgammon, etc.

Gan'grene. A term applied to the first stage of mortification of the flesh. It may result from severe cold, from violent inflammation, erysipelas, and other causes, or may attack open wounds or ulcers. The part attacked loses sensibility and becomes cold and dark in color, while great languor and debility supervene. It may come in old age from a diseased state of the blood-vessels and general weakness.

Gam'ut. [Gk. letter *gamma*; and L. *ut*.] The notes of the musical scale, arranged by Guido d'Arezzo in the tenth century, with *ut* and *gamma* at the ends. The *sol-fa* words were taken by D'Arezzo from the first syllables of six lines of a hymn to St. John the Baptist:

*Ut queant laxis
Resonare fibris
Mira gestorum
Famuli tuorum
Solve polluti
Labbii reatum
Sancte Joannes.*

Gan'net. [AS.] A web-footed sea-bird, found in Europe and America, and also called the solan goose. It is a bird of passage, and is very strong on the wing. The gannet follows shoals of herring, on which it feasts. Its skin, feathers, and eggs are much valued.

Gar'bage. Kitchen refuse. In small towns and rural districts this is fed to swine, but in large cities it is difficult to dispose of. In Philadelphia and some other cities it is burned in close furnaces. In others it is utilized in various ways. Thus in St. Louis the oil and grease are removed by the use of naphtha, and employed in soap making. From the remainder a good fertilizer is made.

Gar'goyle. [Fr.] A projecting spout for carrying off water, often cut grotesquely into human and other figures.

Gar'lic. [AS.] A bulbous plant with a strong smell and spear-shaped leaves, used as seasoning. Each root is composed of several smaller bulbs,

cloves of garlic, enclosed in a common membranous coat.

Gar'net. [Fr.] The name of a mineral species which includes numerous varieties, differing in composition, color, and fusibility. It is hard, brittle, and more or less transparent. The red variety is the most common, but brown, and sometimes green, yellow, and black sorts are found. The variety which includes the *precious* garnet consists of silicate of alumina together with oxide of iron. It is transparent, and of a deep-red color, and is much prized as a gem.

Gar'ter. The band to prevent the stocking from slipping down; the badge of the highest order of knighthood in Britain, instituted by Edward III.

Gas. [Du.] Matter is capable of existing in the three forms known as *solid*, *liquid*, and *gaseous*. The gaseous condition of matter is defined as that which is capable of unlimited expansion—that is to say, that a very small quantity of any gas, if introduced into a large empty space, will always expand so as to fill the entire space. A gas may therefore be defined as matter in the gaseous state. An important property of gases is that they may be liquefied, and all gases, even the volatile hydrogen, have been reduced to the liquid state, and many of them to the solid. *Illuminating gas* is an inflammable gas produced by distillation from coal, petroleum, or other carbonaceous material. It is very largely used in cities for lighting and heating purposes, being conveyed in pipes from a central generating station, carried into houses, and burned at a small opening in a *gas burner*. *Natural gas* arises from wells in the earth in petroleum districts, and is similarly burned for house lighting, heating, and manufacturing purposes. Gas was first used for lighting in England about 1800, in the United States, at Boston, in 1822; New York in 1827, and Philadelphia in 1835.

Gas-engine. An engine in which the piston is worked by the alternate admission and condensation of gas in the cylinder. When a mixture of coal-gas and common air or of oxygen and hydrogen is used, condensation is produced by an explosion caused by an electric spark or a gas jet.

Gas-meters. As coal-gas enters each house it is made to pass through an iron box called a gas-meter. Within this box are wheels, which are turned by the gas; and connected with the wheels, but on the outside of the box, are three dials, on which is recorded the number of cubic feet of gas entering the house in any given time. The figures on the left-hand dial stand for hundreds of thousands, those on the middle dial for tens of thousands, and those on the right-hand dial for thousands of cubic feet. To read the index, put down the figure next behind the pointer on each dial, and add two ciphers. In this way, if the index is found to record 16,700 cubic feet of gas, and at the next examination it records 18,300 cubic feet; then by subtracting we find that 1,600 cubic feet of gas has passed through the meter in the interval.—*Gasometer*, a large tank for holding gas.

Gas'tric Juice. The thin watery fluid, with an acid reaction, secreted by a set of glands in the mucous membrane of the stomach. It is the most important digestive fluid in the body.

Gauge. [Fr.] A class of measuring instruments, whereof each has a specific name to indicate the kind of measurement for which it is to be used. Instruments of this nature are used for a variety of purposes, such as finding the capacity of a vessel (as in gauging a barrel), or in ascertaining the pressure of steam or the force of the wind or the amount of rainfall.

The standard gauge, or distance between the rails, in railways is 4 feet 8½ inches. Broad gauge is 7 feet in England and 6 feet in the United States. Any gauge less than standard is called narrow gauge.

Gauze. [Fr.] A fine, thin silk cloth first brought from Gaza; cloth of linen, cotton, fine wire, or thin fabric like silk gauze. There is a flannel called gauze flannel.

Gazelle. [Fr., from Arab.] A small, beautiful and graceful kind of antelope found chiefly in Arabia and Syria, also in Africa, with black, incurved lyre-shaped horns, and soft eyes. They roam in herds, and are the prey of the lion and the panther. When attacked they arrange themselves in a circle and present their horns like the bayonets of a regiment of soldiers.

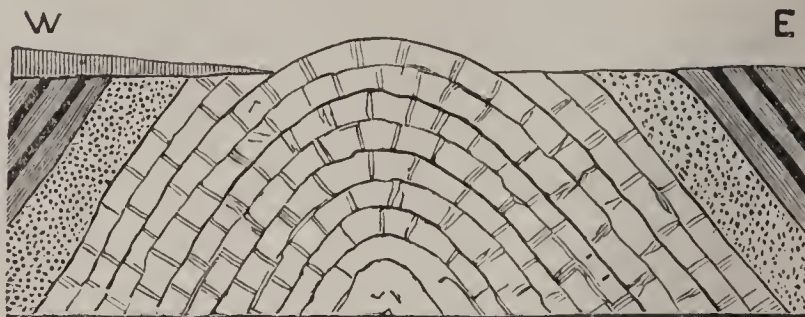
Geiss'ler's Tube. A glass tube in which an almost perfect vacuum is produced, and through which an electrical current is sent. In passing through the vacuum it yields a soft light. These tubes, as modified by Sir William Crookes, yield the light from which the Röntgen ray or X-ray is produced.

Gel'atine or Gelatin. [Fr., from L. *gelatus*, frozen.] An animal substance of a nitrogenous nature, supposed to be closely connected with the albuminous substances. It does not exist already formed in the animal tissues, but is obtained by the action of boiling water on connective tissues, cartilage, ligaments, and tendons. When its solution in boiling water cools, it forms a tremulous jelly. It is nutritious, and much used in soups and jellies. It dissolves in hot water and in acetic acid, but is insoluble in alcohol. It is largely used in many photographic processes. A powerful explosive known as *explosive gelatine* is made by dissolving 5 parts of gun-cotton in 95 parts of nitro-glycerine gently heated in a water bath. (See *Isinglass*.)

Gems'bok. A South African antelope with long, sharp and nearly straight horns.

Geol'ogy. [Gk.] The science which treats of the history and structure of the earth. The rocks which compose the crust of the earth have not all been formed in the same way. Some have cooled from a state of fusion, and are known as *igneous rocks*. This class is represented by such rocks as granite, syenite, traps, and lavas. *Metamorphic rocks* are those which have either originally been deposited in water and have become changed into crystalline rock, or those which, originally crystalline, have become foliated in structure under great pressure. *Sedimentary*

rocks comprise the various deposits which are laid down on the bed of the sea or on the land. They have all been formed from sediment



ANTICLINAL ROCKS

washed by rain and streams from the land, and, being thus derivative, imply the existence of older rock. This division forms the larger part of the earth's crust, and is the most important for the geologist, since it contains most of the materials from which the geological history of the earth is worked out. These rocks are arranged in *strata* or layers, which have been much lifted, contorted and broken. When they are bent with curve upwards, they are called Anticlinal. They include sandstones, limestones, slates or claystones, etc., their ages depending on their relative position. When the age of a rock strata is in doubt it is frequently learned from the animal or plant fossils it may contain.

Gera'nium. [Gk. *geranos*, a crane.] A genus of plants with seed-vessels like a crane's bill. Most of them have showy flowers and a pungent odor. This group includes the commonly cultivated "geraniums" (*Pelargoniums*) which are mostly natives of South Africa.

Germ. [Fr., from L. *germen*, a sprout.] The first form of anything living, from which the egg and the embryo develop. *Disease germs* are minute spores or organisms called bacteria, bacilli, and microbes, which are now known to cause disease.



Most forms of microbes are healthful and many of them very useful, the hurtful species being few in number. Dr. Frankland found 20,222 microbes in one cubic centimetre of Thames water, and after filtration 401 in the same quantity of water. In the air after high winds germs are numerous, but after rain their number is small. Bacillus is a long rod form and

bacterium a smaller rod form of germ.

Ger'man Silver. An alloy of zinc, nickel, and copper. It is used in the manufacture of numerous articles, such as spoons, forks, jugs, teapots, dish-covers, salvers, etc. The proportion of each

ingredient is different in different alloys. Spoons and forks are made from two parts copper, one nickel, one zinc. It is hard, and can take on a bright polish.

Gey'ser. [Icel. *geyser*, from *geysa*, to gush.] The name applied to hot springs, such as were first observed in Iceland, which eject hot water violently either at irregular intervals or periodically. The Great Geyser in Iceland throws up water to a height of from 80 to 120 feet. There are numerous geysers in the Yellowstone region of the United States, some of which throw jets of water to a height of 200 feet. They are also met with in New Zealand and in California.

Gi'la Monster. A large lizard found in the sandy deserts of Texas, New Mexico, and Arizona. It is covered with scales of brilliant orange and jet-black hues, is one of the largest of North American lizards, and has a poisonous bite, its fangs being like those of venomous snakes. Its bite is injurious but rarely fatal to man.

Gill. [Scand.] The opening by which fishes breathe (*q.v.*), and the flap which covers it. Gills are usually thin fringes or plates, through which the blood circulates, and in which it is exposed to the action of the water, from which it absorbs oxygen. The gills of shrimps are the bag-like flaps that hang down where the legs join the body. The gills of an oyster are a delicate transparent frill of four-striped bands.

Gim'let. [Fr.] A small instrument, with a cross handle, grooved body, and a sharp screw at the point, used for boring holes.

Gimp. A kind of trimming used on dresses, curtains, and furniture. It is made of silk, wool, or cotton, stiffened by a fine wire or cord twisted among the threads.

Gin. [Contraction of *juniper*.] A liquid distilled from fermented wort and flavored with juniper berries. Often called hollands because greatly made in Holland. Common gin is flavored with turpentine.

Gin'ger. [Fr., from L. *Zingiber*.] The root-stock of a plant which grows in the East Indies, Africa, and the West Indies. The finest ginger is from Jamaica. Ginger is useful for headaches and asthma, and for flavoring cakes, puddings, ginger-bread, etc. The pale-yellow ginger is the finest; black ginger is of an inferior quality, and is sometimes made into ground ginger. When whitened by chloride of lime, ginger is called bleached ginger. Preserved ginger is the ginger preserved while soft in a thick syrup. It is imported from India and China.

Gin'ger-bread. Sweet bread seasoned with ginger. There is a palm in Egypt called the ginger-bread tree, because its bark looks like ginger-bread.

Ging'ham. [Fr.] A kind of cotton cloth made in Guingamp, in Brittany. Some gingham is of one color, but others are woven in stripes or checks. The origin of *gingham* is also given as from a Javanese word, and the cloth so called is said to have been first made in India.

Giraffe'. [Fr., from Arab.] A ruminant animal with permanent horns in both sexes, and distinguished by the length of its legs and the remarkable length of its neck. It has points of affinity with the deer, the antelope, and the camel, and others peculiar to itself. It is the tallest animal in existence, measuring in some cases from 18 to 20 feet from the top of its head to the ground. Its home is in the woods of South Africa. Leaves of acacia trees are its chief food. It also eats green herbs, but to do this it stretches out its fore feet and bends its neck to collect the grass. Its eye is very beautiful and large, and shaded with long eyelashes. Its enemy is the lion, which watches for it when drinking on the margin of rivers and pools. It fights by kicking with its hind legs, delivering blows with great rapidity, and often wounding and driving off the lion. It is not easily overtaken even by a fast horse. It is also known as the *Camelopard*, (from Gr. *kamelos*, camel; and *pardalis*, leopard.)

Gir'der. [AS.] A strong beam in a building, supported at both ends, for binding the others together. *Half-lattice girder*, a girder consisting of horizontal upper and lower bars connected by a series of diagonal bars sloping alternately in opposite directions, so as to divide the space between the bars into a series of triangles.

Gir'dle. A narrow band of cloth or leather for the waist. *Venus girdle* is a long, flat, ribbon-like, transparent, comb-like marine animal which lives in the open sea.

Giz'zard. [Fr.] A bird's stomach. A hen swallows food without chewing, which is at once stored in the crop, where it remains till it is softened. The food then passes into the gizzard, where it is rubbed and ground between tough,



THE MER-DE-GLACE GLACIER.

hard ribs, like the grooves of a wash-board. To help in this, the gizzard is filled with sharp stones and bits of gravel. These are the hen's teeth,

and they do their work while she is gathering food or roosting. The gizzard of the grasshopper has over two hundred teeth or ribs for grinding its food.

Gla'cial Age. A geological period of late date in which low temperature continued for many centuries and vast glaciers made their way downwards from the polar regions into the temperate zone, leaving their marks in scratched rocks, terminal heaps of stones, and other indications.

Gla'ciers. [Fr., from L., *glacies*, ice.] Slow-moving rivers of ice, which derive their origin from the snow which falls on the higher slopes of lofty mountains. As the snow accumulates on the steep slopes, it acquires a tendency to descend under the influence of its own weight. In some cases it slides down slowly, and in others it breaks off in large sheets, which rush down rapidly, forming what is known as an *avalanche*. These snows, as they descend, gradually become compacted into ice and form glaciers, which extend along channels in the mountain sides to the valleys below. They are widely distributed, being met with in different parts of the American continent, and in Greenland; in Europe they occur in the Alps, in Norway, and in the Pyrenees; and in Asia in the Himalayas.

Gland. [Fr., from L. *glans*, acorn.] A knot of nerves, blood-vessels, and flesh in the body for drawing off certain substances from the blood. Each of the thousands of pores of the skin is really an outlet of a tube which connects with a sweat-gland absorbing water from the blood. Two oil-glands are attached to each hair, and the natural oil ought to be sufficient for the hair. The oily matter runs out of the skin and mixes with the sweat. The sweat produced by the skin of an ordinary man in twenty-four hours measures a pint and a quarter, and weighs $1\frac{1}{2}$ lb.

Glass. [AS.] A substance composed of a mixture of two silicates—one being a silicate of an alkali metal, and the other a silicate of an alkaline earth. There are four different kinds of glass, each of which possesses special properties suited to the particular purpose for which it is used. 1. Crown glass, sheet glass, and plate glass are each composed of the same materials—namely, silicates of sodium and calcium; but the method of manufacture is different in each case. Crown glass was at one time the only kind used in England for windows, but it has been superseded by sheet glass. For plate glass great care is taken in the selection of the materials, and the proportion of lime used is somewhat less than in the other two kinds. 2. Bohemian glass consists of silicates of potassium and calcium. This glass is very hard and difficult to melt, and is much used for chemical apparatus, or whenever a glass is required which can withstand heat. 3. Flint glass, or crystal, contains silicates of potassium and lead. It is employed for table glass, globes, ornaments, etc. Glass for optical purposes is made both of flint and crown glass. 4. Bottle glass is an impure mixture of various silicates, such as sodium, calcium, iron, and aluminium. In this variety the color and quality of the glass are not of the

same importance as in the other three kinds. In glass manufacture the materials are melted together in a highly heated crucible. A portion of the melted mixture is then taken up by the glass-

blower on the end of a long tube, and blown by him into a hollow pear-shaped bulb. It is then given the desired shape by various processes of handling. Many articles of glass are formed in moulds, and other methods of manufacture are employed. The grinding and cutting of glass are subsequent processes for the purpose of ornamentation.

Glass=sponge.

A sponge which forms a framework of spicules of silica, which, when the fleshy parts are washed away, looks like the finest spun

glass. One species is the handsome Venus flower-basket, another is the Japanese glass rope sponge.

Globe. [Fr., from L. *globus*, ball.] A round body imitating the earth and made of some light material. At two opposite points are fixed two pins, round which it turns; these are called the poles. The two pins produced through the centre represent the axis of the globe. The pins turn in two holes made in a brass circle surrounding the globe, called the *brass meridian*. Round the middle of the globe, at an equal distance from the poles, a circle is drawn, and divided into 360° , called the *equator*. Another great circle drawn round the globe, and inclined to the equator at an angle of $23\frac{1}{2}^\circ$, is called the *ecliptic*. It indicates the sun's line of apparent annual motion.

Glove. [AS.] A covering for the hand, with a separate place for each finger. Gloves are made of worsted, cotton, silk, or of different skins. The finest kid gloves are made from skins of kids, but coarser kinds are made from lamb, rat, and other thin skins. They are prepared and dyed, and punched into different shapes for the different pieces of the glove. The two edges to be sewn are placed in a vice having fine teeth like a comb. They are then damped and pressed.

Glow=worm. [AS.] An insect that gives out light in the dark. The female is without wings, and emits the light to attract the male, which is winged. To keep the light bright, this insect has a brush attached to its tail, with which it



keeps its back clean. The light is emitted from segments of the abdomen.

Glu'cose. [Gk. *glykys*, sweet] or **Grape Sugar.** A kind of sugar found in grapes, less sweet than cane sugar. In the United States it is chiefly prepared from corn starch, where the syrup is known commercially as *glucose*, and the solid product from the same source as *starch sugar*. In Europe it is made from potatoes. Glucose is used chiefly in the preparation of table syrups and confectionery, in brewing, in the preparation of artificial honey, and as food for bees.

Glue. [Fr., from L. *gluten*, glue.] A sticky animal substance or kind of impure gelatine, hard, and of a bright brown color. When melted it is adhesive and tenacious. It is made from the horns, hoofs, and sinews of various animals, or from scrapings and cuttings of their skins. These are cleansed, boiled, strained, boiled again, poured into layers or cut into squares and dried. Glue is very useful to the joiner and cabinet-maker.

Glu'ten. [L.] A mixture of various vegetable albuminous substances found in the flour of wheat and other grains. It is a very tenacious substance, and contributes much to the nutritive properties of flour.

Gly'cerine. [Gk. *glykys*, sweet.] A colorless, inodorous, syrupy liquid, having a very sweet taste, soluble in water and alcohol, but insoluble in ether and chloroform. It is obtained from fats. It has numerous uses both in the arts and in medicine. It is used in calico-printing, in perfumery, in leather-making, and in the manufacture of copying ink. When added to water, it lowers the freezing point, and has in this way been serviceable in preventing the freezing of the water in gas-meters. In medicine it is applied externally for softening the skin, and it may be used as a substitute for cod-liver oil. Dissolved in a mixture of nitric and sulphuric acids, it yields the powerful explosive called nitro-glycerine (*q.v.*)

Gnat. [AS.] A small insect with a sting; a blood-sucking fly which undergoes changes of form in water. The females have a needle-shaped proboscis for penetrating the skin of plants and animals. The mosquito is a gnat which injects poison into the wound it makes, and is very annoying in many localities.

Gneiss. [Ger.] The name of a species of rock closely resembling granite. Like granite, it is composed of *mica*, *quartz*, and *feldspar*, but in separate layers. Its texture varies from a fine-grained rock up to a coarse crystalline.

Gnu. A singular kind of antelope, sometimes called the horned horse, and found in South Africa. It is about the size of a half-grown colt. It has short brown hair and a white tail, and a mane on its neck. It has low bent horns and cloven feet, which have all the lightness of those of the stag. Its flesh is like venison, and is much esteemed.

Goat. [AS.] A hoofed animal, closely related to the sheep, and found either wild or tame in almost every part of the world. It is easily tamed,

and is a hardy, healthy animal. Its horns curve outward, its chin is bearded, its covering is of hair rather than wool, and its tail is short. It thrives on scanty pasture, where a sheep could not find support. Goats roam on hills, and in many countries are very numerous. Large flocks may be seen on the mountains of France, Switzerland, and Italy. The skin of the goat makes excellent leather; that of the young goat or kid is used for gloves. Goat-skin also makes morocco leather. The fleece yields two kinds of hair, long and short. Ropes and lawyers' wigs are made of goats' hair. The hair of Cashmere goats is woven into fine shawls. The Angora goat resembles the Cashmere, and its hair is used in making zephyr cloth.

Gold. [AS.] A precious metal, one of the metallic elements. It is distinguished by its bright-yellow color, its great ductility and malleability. It is nearly as soft as lead. It has always been highly prized for its beauty of color and lustre, and its power of resisting oxidation (not tarnishing in the air), and for the ease with which it can be worked into artistic and ornamental articles. Its scarcity has led to its adoption as a convenient medium of exchange. Gold is always found in the metallic state. It occurs in grains and strings, and occasionally in lumps or nuggets, and is found dispersed through the gravel deposits in districts where gold-bearing quartz veins traverse the solid rocks. In order to obtain the gold from the gravel or *placer* deposits, the sand containing the metal is washed in an apparatus called a *cradle*; by this means the lighter materials are washed away, and the gold being heavy, sinks to the bottom. Much gold is also obtained from quartz veins in the rocks, by costly processes of mining and extraction. Gold is found in nearly all countries. It occurs abundantly in Australia, North America, and Africa. Very rich deposits were discovered in Australia and California about fifty years ago, and in South Africa at a much later date. Much gold is now obtained in Alaska.

Gold'finch. A beautiful song-bird of Europe, with gold-colored wings, and known as the yellow-bird. It has a black cap and wings, and is some times called American canary. (See *Finch*.)

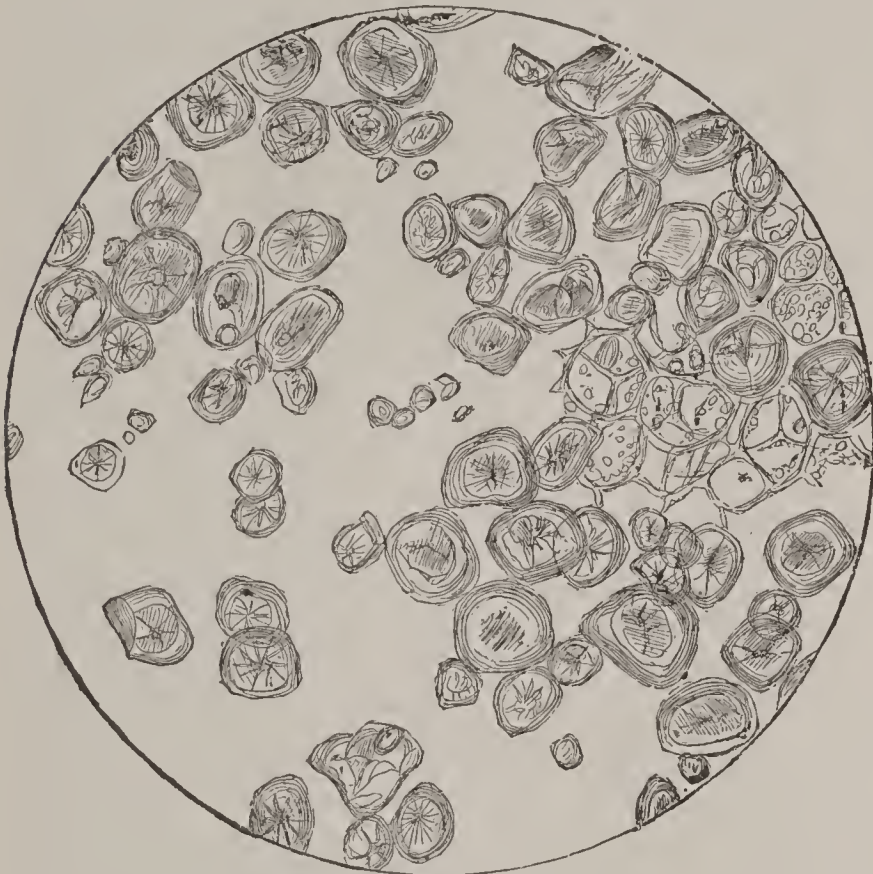
Gold-fish. A small domesticated fish of reddish-golden color, kept in ponds or in glass jars. It is a native of China, and was introduced into Europe in 1691. Many varieties are known. A monstrous variety of gold-fish, with protuberant eyes, is called the telescope fish.

Gold-leaf. This is gold hammered until it forms a very thin leaf. It can be beaten so thin that it would take a pile of 200,000 leaves to make an inch in height. It is used for gilding, by spreading it on wood and other substances. Leaves not so fine are used by dentists for filling teeth.

Golf. [Du.] A game played with a variety of clubs and a ball, the object being to drive the ball into each of a number of holes (usually nine or eighteen) with the fewest strokes of the club. It is a Scotch game, which has of late years become very popular in the United States.

Gong. [Malay.] A round piece of bronze, with a rim round the edge, giving a loud sound when struck. Gong-metal is 78 parts of copper and 22 of tin.

Goose. [AS.] A swimming-bird of the same family as the swan and duck. It is common in most parts of the world. The gander is usually white and the female gray. The goose is larger than the duck. It feeds chiefly on rushes and insects. The common European goose is supposed to have been derived from the graylag goose. The bean goose, the American wild goose, and the Arctic goose are the best known kinds. The Cape Barren goose of Australia, though web-footed, never swims, but is a grazing-bird.



CORNSTARCH CORPUSCLES
Seen under the Microscope.

Wild geese are of a grayish-brown color, and migrate from the tropics to northern regions and the reverse. They fly in two lines like the sides of a triangle, in flocks of from ten to one hundred. They nest in swamp grass, and, though undisturbed by natural sounds, are quickly on the alert on the approach of the hunter.

Goose'berry. [Fr. *grose*, meaning curled or hairy.] A fruit or berry, often rough with hairs, growing on a bush with sharp prickles.

Goril'la. [African.] A remarkable animal; the largest of the ape or monkey tribe. It has immense canine teeth, powerful muscles, and great strength, and does not hesitate to attack the lion, yet it is a vegetarian. It lives in the dense African jungle. It walks in a peculiar way, swinging its body between its long arms. The females and young live much in the trees and the males on the ground. It is very fierce and difficult to capture and tame.

Gos'samer. [O.E., goose summer, or Mary's yarn or threads.] Thin webs or threads of webs

floating in the air, specially in fine weather or in the autumn.

Gourd. The family of plants which includes the pumpkin, squash, melon, cucumber, etc. The bottle or calabash gourd, growing wild in Asia and Africa, bears a fruit like a water-bottle, whose rind is very hard when dry. It is used for bottles, dippers, and other purposes.

Gov'ernor. An instrument used to regulate the supply of steam to the cylinder of a steam-engine. It consists of two heavy balls at the end of two rods, whose other ends are jointed to a shaft, turned by a strap from the engine. When the engine moves these balls revolve and separate by centrifugal force, becoming wider apart the faster the engine moves. They act upon a rod which operates the throttle-valve of the engine. When the engine is going too fast this valve is partly closed and the supply of steam reduced, when going too slow it is opened wider and more steam let in. By this means the supply of steam and speed of the engine are kept uniform.

Graft. [Fr.] A bud or branch of one tree put into another, the stock of which is to support and nourish it. There are various kinds of grafting—cleft, rind, saddle, side, skin, splice, root, and tongue.

Grain. [Fr., from L. *granum*.] A single hard seed of corn. The lines of fibres running along the length of a piece of wood. The grain is the unit of the English system of weights. The pound avoirdupois is 7,000 grains; the pound troy is 5,760 grains. A grain is .0048 of a gramme.

Gramme. The weight of one cubic centimetre of distilled water at the temperature of 4° C. (39.2° F.), weighed at Paris. It is the unit of weight in the metric system.

Gram'ophone. A kind of phonograph invented by E. Berliner about 1895. It has a circular plate of metal covered with a thin film of grease, which the tracing point scratches in a sinuous spiral line. The record is then etched into the plate by acids, and is reproduced in the usual manner.

Gran'ite [Ital. from L. *granum*.] A crystalline rock composed of mica, quartz, and feldspar. In granite each of these minerals is in fragments large enough to be recognized by the naked eye. It occurs in large masses, which have been intruded in many other kinds of rock, and also in smaller masses and veins. It belongs to the class of eruptive rocks, or those which have been pushed up from beneath to the surface by the action of heat. It is met with in great abundance both in Europe and America, and is much used in public buildings, in making docks, and in paving streets.

Grape. [Fr. from O. Ger., a hook or cluster.] The berry or fruit of the vine (as one of a cluster). The berries are smooth-skinned, and have a juicy pulp, and are grown for table use and for making wine and raisins. The principal wine-making countries in Europe are France, Spain, Italy, Portugal, and Germany. Much wine is made in the United States. Many grapes are also grown in Greece, Australia, Cape of Good

Hope, and other countries. The grapes of Greece and Asia Minor are made into raisins.

Grape Sugar, (See *Glucose*.)

Graph'ite. Native carbon in six-sided crystals or in granules, with a black color and metallic lustre. It is used for pencils, for crucibles, and as a lubricator.

Graph'ophone. A modification of the phonograph, which uses, instead of tin-foil, a mixture of wax and paraffine spread upon paper. For commercial purposes this instrument may take the place of the stenographer, correspondence being dictated into it and reproduced by the copyist. For entertainment it will yield a great variety of speech, song, and music.

Grass. [A.S.] Herbage; green fodder; the plant which forms the food of cows, horses, and other hoofed animals; also the class of grain plants with narrow leaves and hollow stems, as wheat, oats, barley, rice, etc. A meadow is a field permanently occupied by grass. When the grass is eaten off by animals it is called a pasture, and when allowed to grow and made into hay it is called meadow hay. Bamboos, though high, are also jointed like grasses. Grasses produce flour, meal, starch, sugar, beer, whiskey, paper and everything made from straw.

Grass'hopper. [A.S.] A small insect that hops among and feeds on grass in summer. Most grasshoppers are colored like the leaves and grasses on which they feed. They do not move in flocks, and are more active at night than by day. They cannot walk, but move by leaps. They have large wings, but do not fly far. The males make a shrill sound with their wings. The katydid makes a sound which is sometimes heard a quarter of a mile distant. The eggs of the grasshopper are covered with a thick skin, and lie all winter in water. Turkeys and other fowls devour many grasshoppers.

Grate. [Low L., a framework of bars.] A set of bars within which the fire burns. In ordinary fire-places most of the heat goes up the chimney, and to prevent this the back and sides of the grate are lined with fire-clay or made of fire-bricks, which reflect the heat into the room.

Grav'el. [Fr.] Loose, rounded, water-worn fragments of rock in which the pebbles range in size from a pea to a walnut. When smaller, they form sand; and when larger, shingle. Gravel is formed by the action of rivers and of the sea; and, since the pieces of the harder species of rocks are best able to withstand the action of water, gravel is found to consist chiefly of fragments of quartz and other silicious materials.

Gravita'tion. The name given by Sir Isaac Newton to his law of attraction, by which every atom in the universe attracts every other atom, with a force varying with distance. It is this force which holds the heavenly bodies in their places, causes the planets to revolve round the sun, and makes falling bodies descend to the earth. The force of attraction is called *gravity*. On the earth it causes a body to fall 32.2 feet a second.

Grebe. A crested swimming-bird about the size of a duck. When swimming it steadies its legs

at the rear end of its body, and paddles with its lobate toes in the water. Its nest is a light raft, and floats on the lakes and ponds, where the tall rushes and reeds grow. If an enemy discovers the nest, the bird puts one foot out, and, using it as a paddle, guides the nest to safer waters. As soon as the young are hatched the male leads the little ones into the water. When they are tired of swimming they mount upon the backs of the old birds. The mother bird induces them to dive by holding food in her beak, going backwards as they come near, until she gets them to go under the water to catch it.

Grippe. (See *Influenza*.)

Grouse. [Fr.] A game-bird that lives among heather on hills. It inhabits Europe, Asia, and North America. It has a plump body, strong, well-feathered legs, and mottled plumage. Among the varieties are the red grouse, the hazel grouse, the ruffed grouse, the pine grouse, and the spruce partridge.

Grub. [A.S.] A worm or larva produced from the eggs of moths, beetles, etc. Grubber is a machine or tool for uprooting stumps or breaking roots.

Gua'no. [Span.] The dung of a sea-fowl, used as a manure, because it contains an abundance of the silicious skeletons of animalcules, and is rich in phosphates and ammonia. Guano was first brought to Liverpool in 1839, from the Chincha Islands on the coast of Peru, but is now exhausted there. It is now obtained from the Macabi and the Huanape Islands. Countless numbers of sea-birds have lived on these islands for thousands of years, and as rain seldom falls their excrement has accumulated to a depth of 200 feet. Guano has a pungent smell, due to the ammonia it contains. By adding to the guano some sawdust wetted with sulphuric acid, the ammonia is fixed, so that its loss is prevented. Guano is an excellent manure for wheat, potatoes, and green crops on strong clay soils. In the great bat-caves of San Antonio, Texas, a shaft has been sunk some hundreds of feet back from the mouth, by means of which it is possible to dig out the guano of the bats without disturbing the enormous number of sleeping bats that doze there during the day. The guano of these bats is the finest exported, because never exposed to rains, which wash out much of the virtue of Peruvian guano.

Guil'lemot. [Fr.] One of several northern sea-birds allied to the auk. It has short legs placed far back, and is expert at diving and swimming. The common guillemot or murre is abundant on the northern coasts of Europe and America, and lays one or two eggs on the barren rocks without any nest.

Guil'lotine. [Fr.] An instrument with an upright frame and a heavy axe, used in France for executions; also a paper-cutting machine with descending knife worked by hand or steam.

Guin'ea. [African.] A coin first made in 1663 of gold from Guinea in Africa, worth 21s. No guineas have been coined since 1817.

Guin'ea-fowl or Guin'ea-hen. A bird somewhat like a turkey, of a dark-gray color and with white

spots. Its neck is long, and its head has a top-knot, and a fleshy horn on each side. It is noisy and quarrelsome in the farm-yard, but its noise protects poultry from the hawk. Its flesh is a delicacy, and its eggs are valued for their richness.

Guin'ea-pig. A small rodent animal from South America, somewhat like a pig, but also like a rabbit. It has short glossy fur, dark brown or white, with black, white, or yellow patches, or tortoise-shell colors. It feeds on vegetables, especially parsley and carrot tops. It is also called cavy, (*L. Cavia*.)

Guitar'. [Fr., from Gk.] A musical instrument with six strings, the three highest of which are of catgut, and the three lowest of silk covered with silver wire.

Gulf Stream. A great ocean current of warm water, which flows in the Atlantic from the equatorial region, through the Gulf of Mexico, and along the eastern coast of the United States at some distance from land. Its waters cross the ocean and reach the shores of Europe, whose climate is made warmer by its heat.

Gull. [Celt.] A web-footed sea-bird. Gulls live upon fish, but many follow ships for long

Arctic regions. The tern or sea-swallow has long slender wings. The albatross (*q.v.*) is another large gull. The stormy petrel (*q.v.*) is the smallest of web footed birds.

Gum. [Fr., from Gk. *kommi*.] The sticky or adhesive juice of certain trees or plants. Vegetable resins are insoluble in water, but soluble in spirits. Gum resins are soluble in either water or spirits. Gum copal is a fossil dug out of the ground in various parts of the earth. It is brought in large quantities from the east coast of Africa. It is found in the sandy plains about a foot from the surface, and is derived from trees of recent times, while amber is from forests of a past geological period. Gum arabic is the juice of several acacia trees that grow in Arabia, India, and Africa, and dissolves in water. Dextrin is made from starch by mixing it with nitric acid, and is now used instead of natural gums. It is used in calico-printing and for postage-stamps. The Gum tree of Australia is the eucalyptus (*q.v.*), with rigid leaves turned to the zenith, and secreting resinous gums. Two American trees are known as the sour gum and the sweet gum.

Gun. An instrument made of a hollow tube for firing shots by means of explosives. The word is applied to the ordinary musket and rifle, and also to cannon of all sizes. Guns increased enormously in size during the past century. The heaviest cannon on Nelson's ship, the *Victory*, had a 68-pound ball. Cannons are now made which will send a ball of more than a ton weight.

Gun-Cotton. An explosive prepared by steeping cotton-wool in a mixture of equal volumes of strong nitric and sulphuric acids. The cotton, after drying, is not perceptibly altered in appearance, but its weight has increased about 70 per cent., and it has become very inflammable. It is largely used instead of gunpowder, over which it possesses several advantages. The explosive power of one pound of gun-cotton is more than three times that of the same weight of gunpowder. Collodion, used by photographers, is gun-cotton combined with alcohol and ether. Celluloid is gun-cotton combined with camphor and other substances.

Gun-metal. A bronze usually composed of nine parts of copper and one of tin, used for cannon.

Gun'ny. A cloth made of jute fibre. Gunny cloth is a coarse bagging in which pepper, ginger, sugar, etc., are shipped from India. It is also brought to the United States and used to cover cotton bales.

Gun'powder. A well-known explosive, consisting of an intimate mixture of nitre, charcoal and sulphur. In the manufacture of gunpowder the ingredients selected must be perfectly pure, and they must be reduced to powder separately. They are then roughly mixed, sprinkled with water, and formed into a cake, which is afterwards broken up, granulated, and separated into classes by sieves of different sizes of mesh. The violence of the explosive power of the substance is due to the sudden evolution of large quantities of gas. Gunpowder is supposed to have been



COFFEE ADULTERATED WITH CHICORY, MAGNIFIED.

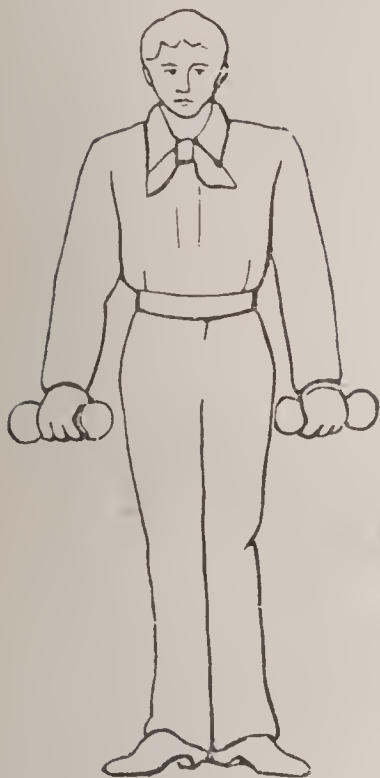
distances to pick up the pieces of food thrown overboard. They also rob weaker birds of their food, and have been known to snatch fish from the beaks of pelicans. They vary in size, some being small like pigeons, others about 17 inches long. The bill is yellow, and the feet and legs of a greenish-white color. The back and wings are gray, but the head, breast, tail, and under part of the body are pure white. The gull lays three eggs of brownish-olive color, nearly as large as those of the common fowl. All gulls have weak feet and three webbed toes. The largest gulls are the burgomaster or glaucous gull, and the skua or Arctic gull, which frequent the

known to the Chinese before the Christian era, but is believed to have been first used in warfare

in the seventh century by the Byzantine emperors in the defence of Constantinople.

Gur'net and Gur'nard.

[Fr., from L. *grunnire*, to grunt.] A kind of marine fish, supposed to make a grunting noise when taken out of water by the vibration of the muscles of its air bladder. It has a large and spiny head, with mailed cheeks and large eyes. Some gurnards are highly esteemed for food. The flying gurnard is found in the Atlantic, and is able to fly like the flying-fish. It has large pectoral fins filled with nerves, by the aid of which smaller animals are detected. Thus they serve as food-providers.



GYMNASTICS.

Gus'set. [Fr., from Ital. *guscio*, a husk or pod.] A small piece of cloth let into a garment for

strengthening or widening it, especially under the arm-hole of a shirt.

Gut'ta-per'cha. [Malay.] The hardened juice or gum of a tree called percha, common in the Malay Islands. (See *Caoutchouc* and *India Rubber*.)

Gymnastics. [Gr.] A series of exercises arranged according to method for developing and strengthening the muscles and bodily organs. These include work with dumb-bells, Indian-clubs, wands etc.

Gyp'sum. [Gk. *gypsos*, chalk.] Sulphate of lime a common mineral, of which there are large beds in many parts of the United States. When burned and ground it becomes plaster of Paris. Ground gypsum is often used by farmers as a manure. Alabaster is a fine grained white or light-colored gypsum. Satin spar, a beautiful fibrous variety, is used for necklaces and inlaid work.

Gyroscope. [Gk. *gyros*, a circle; and *skopein*, to see.] An apparatus consisting of a heavy rotating disk mounted on gimbals, so that it can turn in any direction. When rotating it will constantly point to the same star, and may therefore be employed to show that the apparent rotation of the heavenly bodies is due to the rotation of the earth on its axis in the opposite direction.

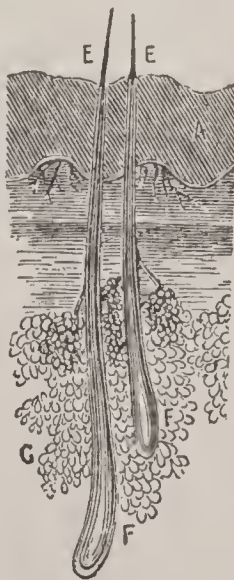
H

Had'dock. (*Gadus æglefinus*.) A food fish of the Cod family, found in large shoals not far from the shore. It weighs from 2 to 4 lbs., and is distinguished by a large black spot on each side, fabled to be the prints of the finger and thumb of St. Peter when he took the tribute-money from its mouth. The haddock is found off the Irish and Scottish coasts, and from New York to the Arctic Circle in the Atlantic. Large quantities are cured in the fishing villages of the east coast of Scotland. The method employed is to cleanse the haddock, steep it for a short time in brine, and smoke it over a wood fire. This was first done in the village of Findon, Kincardineshire, and the fish cured in this way are now known by the name of *Findon* or "Finnan" haddocks.

Hail. [AS. *hagel*.] Frozen water falling from the clouds. There are two kinds of hail, the small grains, which often fall in winter, and generally come before snow; and larger hail, which falls usually in hot weather. The first kind is caused by the freezing of rain-drops as they fall through air colder than that from which they started. How the second kind is formed is not well known. It is supposed to be the result of a tornado whirl in the upper air. Sometimes the particles of hail meeting congeal into large masses called hailstones. These hailstones often do great harm to crops.

Hair. A fine thread-like substance, of various forms and colors, developed from the outer skin of mammals. Each hair consists of a shaft and root. The shaft or part above the skin does not grow, but the bulb or part under the skin, which

is made up of little cells, grows by forming new cells, the old ones being pressed forward, and becoming a part of the shaft. Its color is said to be caused by a kind of oil which comes from the cells in the bulb. Porcupine quills, hedgehog spines, and rhinoceros horn are all developments of hair. Straight hair is nearly round, but curly or crisp hair, like that of the negro, is flattened, and the hair of the Bushman in Africa is nearly as flat as a ribbon. Hair is very strong and very lasting. It is also very elastic or springy, and for this reason is much used for stuffing cushions, mattresses, sofas, etc. Horse hair is used for making hair-cloth and other purposes, and the hair of cows, camels, goats, and dogs is used for weaving, and the hair and fur of beavers, rabbits, and other small animals for making felt. Hogs' hair and bristles are largely used in brush-making. Human hair is used chiefly for making wigs, curls, etc. Most of it comes from France, Italy, Germany, Russia, and South America. Young peasant women sell their hair to wandering dealers, who go round to collect it. These sell it to hair-merchants, who partly dress it, and sell it again to the wig-makers. Human hair is also plaited into ornamental work, such as chains, brooches, and pictures and this has in some countries become a kind of art.



HAIR MAGNIFIED.

E, Shaft; F, Root; G, Fat-Cells.

Hal'ibut. [O.E. *Hali*, holy; and *butte*, flounder.] A large, flat sea-fish eaten on holidays. It weighs from 100 to 400 lbs., and is caught by hook and line from Spitzbergen to Iceland, and from Finland and Scandinavia to the British and French coasts, and along the Atlantic coast from New York northwards. The bait used is small herring.

Hallow=even or Hallowe'en'. This is the evening of the 31st of October, so called as being the eve of All-Hallows, or festival of All-Saints, which falls on the 1st of November. It is a night on which spirits, good and evil, are supposed to be abroad and witches to hold high holiday. Then nuts and apples are in great demand, and are used for the purpose of foretelling future events in love affairs. In the north of England Hallowe'en is known as Nutcrack Night.

Ha'lo. [Gk. *halos*, a round threshing-floor.] A white or colored circle of light round the sun or moon. These circles are due to the presence of ice crystals in the air. In paintings, the heads of holy persons are sometimes surrounded by a ring called a halo.

Ham'mer. [Sax. *hamer*.] A well-known tool used for driving nails, beating metals, etc. Hammers are of various sorts, but nearly all consist of an iron head fixed crosswise to a handle of wood. Almost every kind of trade has a hammer of its own. *Power hammers* are those which are worked by machinery. Among them are forge-hammers, used for hammering into shape heavy masses of red-hot iron; and tilt-hammers, used for lighter work, such as forging bars of steel. The steam forge-hammer was invented by James Nasmyth in 1839.

Ham'mock. [Span. *hamaca*.] A kind of hanging bed, chiefly used by sailors. It consists of a piece of hempen cloth or of strong netting, 6 feet long, and 4 feet wide, gathered together at each end and hung to hooks under the deck. Hammocks of netting are often swung from trees in gardens as a pleasant place for resting in fine weather.

Hand. The extremity of the arm, consisting of the palm and fingers, connected with the arm at the wrist. In all there are 27 bones in the hand. Eight of these are carpal bones, and form the wrist; 5 are meta-carpal bones, found in the palm; and 14 are phalanges—2 in the thumb and 3 in each of the fingers. The hand is the organ of touch, and there is no part of the body where the sense of touch is so acute as at the tips of the fingers. The activity and pliancy of the movements of the hands are remarkably displayed in the playing of the pianist and violinist. A skillful pianist produces about 960 notes a minute in quick time; and this gives a fair idea of the rapidity of movement which can be attained by the hand.

Han'dicapping. A term used in various sports and games to indicate the position of competitors, so that all shall have as nearly as possible an equal chance of winning. In horse-racing, weights are put upon horses not less than three years of age in proportion to their recorded performances. In foot racing, cycling contests, etc., competitors are started at different distances in proportion to

previous performances. In chess and draughts, certain "men" are given up by the better player; and so on in other cases.

Hang'ing Garden. A series of magnificent gardens laid out on elevated terraces at Babylon. They were said to be 400 feet square, thus containing nearly four acres, and over 300 feet high. Water



HANSOM.

was forced up from the Euphrates to cool the air, water the soil, and supply the fountains.

Hansom. A low two wheeled cab closed in front by a lid-like apron and having a driver's seat perched back of the top. It is drawn by one horse and used extensively in large cities to convey passengers from one point to another.

Har'bor. [Sax. *here-berga*.] A port or haven for ships. A general name given to any bay or inlet affording ships protection from the wind and sea. Some of these are natural, but many are constructed by breakwaters. In connection with harbors artificial docks are constructed, in which the water is kept nearly at the same level, which gives facility in loading and unloading.

Hard'pan. A stratum of hardened clay, sand, or gravel, from one to three feet under the soft soil, which it serves as a foundation.

Hare. (*Lepus*.) [Sax. *hara*.] A well-known animal, with long ears, a short tail, soft hair, and a divided upper lip. Hares are found almost all over the world. They differ from rabbits chiefly in their habits. Rabbits live together in burrows dug under the ground; but hares live separately, each one making a nest of grass for itself. They pass the greater part of the day in sleep, and in the evening creep out to feed. Green vegetables and root crops are their chief food. Hares are very timid, and move swiftly by leaps. They afford fine sport to the hunter, and in some countries are hunted with hounds. Their flesh is very good, and is much used for making soup.

Har'lequin. The name of one of the characters in a pantomime; of Italian origin. The harlequin is the trickster and the wit of the play, and commits all sorts of knavish acts.

Harmo'nium. A musical keyed instrument in which the tones are produced by forcing air by means of a bellows so as to cause the vibration of free metallic reeds. The first instrument of

a really useful kind was the invention of Debain of Paris, in the year 1840. This instrument has now become one of the most common for use in homes, schools, and places of worship.

Har'ness. [Fr. *harnois*.] The trappings of a draught-horse, whether for a wagon, coach, gig, etc. It may be said to consist of four parts: (1) the driving part, or bridle and reins; (2) the drawing part, consisting of the collar, hames, and traces; (3) the supporting part, for holding up the shafts, made up of the saddle and its parts; and (4) the holding-back part, or breeching.

Harp. [Sax. *hearpa*.] A musical stringed instrument. It was very much esteemed by the ancients, and is pictured on the Egyptian monuments. The modern harp is in form nearly triangular, and the wires stretch from the upper part to one of the sides. It stands erect, and is played with both hands by pulling the strings with the fingers and thumbs. The harp is now sometimes used in an orchestra.

Harpoon'. [Fr. *harpon*.] A spear or javelin used for the capture of whales and other large fish. It is made of iron, about 5 feet long, with a sharp flat point with barbs. The edges of the point are made sharp, so that it will go into the whale easily, and then the barbs keep it from pulling out. It is thrown by the hand, but sometimes is discharged from a gun. The *gun-harpoon* is a short bar of iron, with a ring at the end to fasten a rope to. This is fired from a small cannon in the bow of the boat.

Har'row. [Sw. *harf*.] An implement of agriculture chiefly used for breaking up lumps of earth and smoothing ploughed land, and for covering the seeds previously sown. It consists of a frame of varied form, now chiefly made of iron, in which are fixed rows of iron spikes.

Hat. [Sax. *hæt*.] The principal outdoor covering for the head. Hats are chiefly made of felt, silk, or straw. For felt hats the fur of rabbits and hares is used, and for commoner kinds sheep's wool. Silk hats are made of two or three layers of calico saturated with varnishes, moulded into shape on wooden blocks, and covered with fine silk plush. In the manufacture of straw hats the straw commonly used is that of wheat or barley.

Hawk. [Sax. *hafoc*.] A name common to many species of birds of prey belonging to the Falcon family. Hawks differ from true falcons by having shorter wings and an unnotched bill. (See *Sparrow Hawk*.)

Hawk'ing. The art of training and flying hawks, to capture other birds. This practice, called *falconry*, is of high antiquity, and in old times was a favorite amusement with the rich, and to some extent with the poor. It has now gone out of use.

Haw'thorn. [Sax. *hægthorn*.] A shrub or small tree which bears the *haw*. It is a native of Europe, Siberia, and the north of Africa. In Britain it is largely planted both for hedges and for ornament.

Hay. [Sax. *heg*, *hig*.] The stems and leaves of grasses cut and dried for fodder. After being

mown, the grass is shaken up and spread abroad evenly over the ground, to be dried by the sun. This is continued for several days, the hay being raked into windrows at night and into small heaps if rain threatens.

Hay Fever. A warm weather disease; its symptoms are those of common catarrh, yet very difficult to cure, and recurring annually at a fixed time. It is thought to be due to the pollen of certain plants. Some persons are very susceptible, but most people not at all so.



HAWK.

Ha'zel. [Sax. *hæsel*.] A genus of nut-bearing plants or small trees of the order Coryleæ. The hazel is a native of all the temperate parts of Europe and Asia. It is also common in North America. In England the hazel is cultivated for its nuts (*filberts*), from which, on pressure, a valuable oil is obtained. The wood of the hazel is largely used—the smaller kind for making crates, baskets, hoops, whip-handles, etc.; and the larger wood for charcoal, which is in great demand for forges, for the manufacture of gun-powder and of artists' crayons.

Heart. [Sax. *heort*.] A hollow muscular organ, with four chambers, in the higher animals. It is the centre of the blood's motion in an animal body, and is situated in the thorax. The blood flows from the veins to the two right chambers of the heart (auricle and ventricle), then to the lungs, next to the two left chambers, from which it is driven into the arteries. Thus the circulation is carried on and life maintained. The heart of a reptile has only three chambers, and of a fish only two, so that the blood is imperfectly aerated, and there is little animal heat.

Heat. A force in nature known by its effects in fusion and evaporation. Formerly it was supposed to be a subtle fluid, which was known as caloric. It is now regarded as a kind of motion,

being in general a form of vibration or disturbance of molecules. One of the most important effects of heat is to alter the temperature of bodies. A piece of iron put into burning coals becomes hot, because the heat passes from the coals into the iron, until both have reached the same temperature. Heat also alters the dimensions of bodies. For example, the tire of a wheel is made a little too small, and when heated it enlarges so as to slip on easily. It cools down to the same size as it was at first, and then fits so tightly that it binds all parts of the wheel firmly together. The ends of rails are always left a little way apart on railroads; for if rails were laid close together the heat of the sun might expand them, and push them out of place. Heat is communicated to different bodies in at least three distinct ways. First, by convection, as when water is heated in a kettle (over the fire). Second, by conduction—that is heat traveling from one end of a substance to the other end. Hence we have good and bad conductors of heat. Metals are good conductors, glass is a bad conductor, and wood is a still worse one. This is the reason why iron tools for heating in fires have wooden handles fitted to them. A third way is called radiation. This may be best illustrated by placing some substance near a fire. The heat passes over to it or is radiated to it from the fire.

Heath. [AS. *hæth*.] A genus of narrow-leaved evergreen shrubs of many species (from 400 to 500 are known). Over a dozen inhabit Europe, and have small pink flowers; the remainder are natives of South Africa, many of them bearing brilliantly-colored flowers. *Heather* is a species of heath.

Hedge. [AS. *hege*.] A fence of thorn bushes or other shrubs or small trees planted round a field, or in rows to separate the parts of a garden. Hedges are very common in many parts of Britain and Italy, but comparatively rare in France and Germany, as well as in America. They are usually of one or more of the following species: hawthorn, blackthorn, privet, holly, beech, maple, alder, poplar, willow, yew, sweet-brier, etc.

Hedgehog. [L. *Erinaceus*.] An insectivorous animal, with the power of rolling itself into a ball,



and with its hairs developed into sharp, strong spines. Few animals care to attack it, and those that do are usually driven off by the armor of spines. Fourteen species are found throughout Europe, Africa, and most of Asia. The common hedgehog is about 9 or 10 inches long, the spines on the back measuring about an inch. It is nocturnal in its habits, hibernates, and feeds

on insects, mice, and worms. It is useful in a garden, and has been rendered domestic, and used to destroy cockroaches.

Hel'met. [AS. *helan*, to cover.] A head covering formerly largely in use as a defensive armor. It is now chiefly used for ornament, but firemen wear it as a protection from falling materials at fires, and in hot countries helmets of white felt covered with rolls of linen are worn as a protection against the sun's rays.

Hem'atite. An abundant and valuable ore of iron, the sesqui-oxide. Vast quantities of it exist in the United States, especially in Michigan and Missouri. In the latter, two mountains, Pilot Knob and Iron Mountain, consist chiefly of this ore.

Hem'lock. [A S. *hemleac*.] A plant of the genus *Conium*, whose leaves and root are poisonous. The common or spotted hemlock is from 2 to 7 feet in height, and grows by waysides and on heaps of rubbish. It is common in Europe and in some parts of Asia, and is now also a naturalized plant in North America and Chili. A valuable medicine is obtained from the leaves and fruit. *Water hemlock* grows in ditches, on the margins of ponds and on wet grounds in Europe and the north of Asia. It is a very poisonous plant, and is the cause of many deaths. *Hemlock spruce* is an evergreen cone bearing tree, common in North America. It is a beautiful tree, often growing to the height of 100 feet. The bark is largely used in tanning leather.

Hemp. [AS. *henep*.] A fibrous plant of the genus *Cannabis*. It is cultivated in many parts of the world, but most largely in Poland and in the centre and south of European Russia. Hemp varies from 4 to 12 feet in height. The stem is hollow or filled with pith, and the bark contains a useful fibre, which is extracted and used for making canvas, ropes, sail-cloth, bagging, and other articles. The seed is often used to feed poultry and small birds, and it also yields an oil very good for burning, and also a narcotic resin called *hasheesh*.

Herb. A plant with a soft stalk, and which bears flowers and fruit only once, and then dies. Some live one year only, others two or more years.

Herba'rium. [L. *herba*, a plant.] A collection of specimens of plants, carefully dried and preserved. These collections are very valuable for the scientific study of plants, and there are some in existence which are centuries old.

Her'on. [Fr.] The name of a large tribe of wading birds found in almost every part of the globe. The body is small in proportion to the length of the neck and the legs. The legs are very long and slender, and the bill is longer than the head, and comes to a sharp point. Herons feed mostly on fish, frogs, crabs, and other water animals. These they greedily devour. They build their nests in high trees near the water, and feed their young with fish until they are old enough to care for themselves. The European heron is remarkable for its directly-ascending flight, and was formerly hunted with the larger falcons.

Her'ring. (*Clupea harengus*.) [AS. *hæring*, from the root *here*, an army.] A well-known sea food-fish. Herrings are found on the shores of the North Sea, the North Atlantic, the Baltic, and the White Sea. They approach the coast every spring in order to spawn, and then the great herring-fishing season commences. They move about in immense schools—the main body often divided into columns of from five to six miles in length and from three to four in breadth—swimming near the top of the water, and followed by multitudes of larger fishes and by gulls, fish-hawks, and other sea-birds, which feed on them. Drift-nets are employed in catching herring. These are let out from boats, usually in the evening; and when the fish are taken to the shore they are cleaned, salted, and packed in barrels. The fish locally known as herring in the American rivers south of Maine is the alewife, of the same genus as the shad. It is very abundant and much esteemed. There is also a Pacific herring whose abundance resembles that of the Atlantic species, and whose fishing is of growing importance.

Hick'ory. A tree belonging to the Walnut family, found only in North America. The wood is tough and elastic, and is largely used to make hoops for casks. Handspikes, carriage shafts, wheel spokes, handles of axes and golf clubs, large screws, etc., are made of it. The trunk is slender and has a very rough bark, and the tree grows to a height of from 60 to 100 feet. The *hickory-nut* has a delicious flavor. One southern species yields the esteemed *pecan-nut*, others yield the *pig-nut*, *bitter-nut*, and *mockernut*.

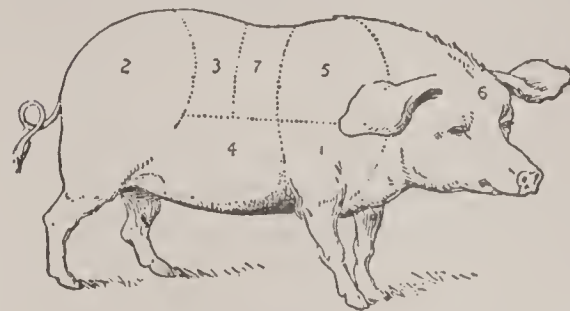
Hieroglyph'ics. The name applied to the ancient Egyptian writing, in which the forms of animals and natural objects stand for words, and sometimes for syllables or letters. Chinese writing is similar in character, and all systems of writing are thought to have begun with hieroglyphics.

Hippopotamus. [Gk. *hippos*, a horse; and *potos*, a river.] A large animal about 12 feet in length and 5 feet high at the shoulders, with short legs and four toes on each foot, a skin on the back and sides more than two inches thick—of dark-brown color and destitute of hair. It is found only in Africa, and lives mostly in lakes and rivers, and can remain a long time under water. At night it comes up on the banks of rivers, and feeds on plants and herbage. It lives in herds of from twenty to forty individuals. The hippopotamus is much hunted by the Africans for its flesh, of which many of them are very fond. The hide is converted into shields, helmets, whips, and canes, and the large canine teeth are much valued for their ivory, and form a very considerable article of African commerce.

Hive. [AS. *hyfe*.] See *Bee*.

Hog. The common name of the animal also called pig, and collectively *swine*. The eyes of the hog are very small and sunken, his nose is mobile, his form without beauty, his motions clumsy, and his appearance slothful and stupid. The hog is highly prized for its flesh, which supplies a chief article of food to many nations in the form

of pork, bacon, ham, sausage, etc. Its fat is made into lard, its skin into leather for the saddler and trunk-maker, and its bristles are largely used in



1 SHOULDER
2 LEG AND HAM
3 HIND LOIN
4 BRISKET
5 SPARE-RIB
6 HEAD
7 FORE LOIN

the manufacture of brushes. Wild hogs are common in many countries, and are hunted in various places. They are dangerous on account of their expert use of their tusks or long canine

teeth. Wart-hogs have large lobes on each side of the face, and remarkably modified teeth. The African river-hog is of a gray color, and the West African red river-hog is remarkable for vivid coloring and long pencilled ears.

Hogs'head. Formerly a measure of capacity in use in England, containing 63 wine gallons and 54 ale gallons. In the United States the measure is still in use, and the term there signifies a large cask containing from 110 to 140 wine gallons.

Hol'y. [AS.] A shrub or tree with shining, prickly, and smooth and wavy leaves and scarlet berries. The common holly grows in Europe, and in some parts of Asia. It is largely used for hedges, and forms an excellent fence. The American holly is found along the coast of the United States. It grows to be a tree of considerable size. The wood of both kinds is very hard, fine-grained, and almost as white as ivory, and is much used by cabinetmakers, turners, and musical instrument makers. The bark yields a substance from which bird-lime is made, and is used as a febrifuge, while the berries are a violent purgative. Branches of holly are largely used at Christmas for decoration. The Brazilian or Paraguay holly yields leaves from which the *mate* or *Paraguay tea* is made. It is more exciting than ordinary tea, and if taken to excess produces a kind of intoxication.

Holly'hock. [AS. *holihoc*.] A well-known hardy plant, the *Althæa rosea*, cultivated in gardens for its spikes of large and beautiful flowers. It is called also *rose-mallow*.

Hom'iny. [W. Ind.] Maize hulled and crushed; prepared for food by boiling in water.

Hone. [AS. *han*.] A hard stone of very fine grit, used in sharpening knives, razors, and various sharp-edged tools. The best stone for hones is found in Arkansas and Turkey, and when in use is wet with oil. Coarser hones are usually called *whetstones*, and are wet with water.

Hon'ey. [AS. *hunig*.] A very sweet substance collected by honey-bees from the juices in the flowers of plants, and deposited in the cells of the honeycomb. Heather honey is of a rich yellow color. Narbonne honey is white, and is made from rosemary flowers. The fine aroma of Maltese honey is due to orange blossoms. In the United States the finest is from forests of

basswood and white-clover pastures; also honey from buckwheat is abundant. Honey is largely used as an article of food, in sweetmeats, in some kinds of ale, and also as a flavoring in medicines. The old intoxicating drink called mead was made from honey.

Hon'ey-suckle. A genus of flowering and climbing plants or shrubs, often planted in shrubberies and trained against walls on account of the beauty and delicious fragrance of their flowers.

Hoof. [AS. *hof*.] The horny substance which incases the feet of horses, cows, sheep, etc. Horses' hoofs, which are harder, are made into glue and ground up for artificial manure. Prussiate of potash, used for making Prussian blue for dyeing and calico printing, is made from horses' hoofs. (See *Horn*.)

Hop. [Du. *hop*.] A well-known climbing plant, very extensively cultivated in the south-east of England. It is a native of Europe, and is now grown in the United States and in Australia and New Zealand. It is largely grown in some of the American States, especially in New York. The plant is cultivated for its flowers, which are gathered or picked dried in kilns, bleached with sulphuric acid, and then used in making beer. They give it a bitter taste, and help to make it bright and clear. *Hop bitters* are used as a tonic.

Hore'hound. [AS. *harhune*.] A small plant with whitish stem and flowers. It has an aromatic smell, and is a popular remedy in cases of coughs and asthma.

Hori'zon. [Gk. *horizon*.] A circular line touching the earth, and formed by the apparent meeting of the earth and sky. This is called the *visible* or *sensible horizon*, while the great circle parallel to the sensible horizon, and passing through the earth's centre, is the *rational* or *celestial horizon*.

Horn. [AS.] A hard substance, usually of considerable length, growing on the heads of some animals, and also as the hoofs, claws, or nails of animals generally. The horns of the Ox family are never shed; the antler of the deer is bone, and is shed annually. Horn is a tough, flexible, semi-transparent substance, and is softened by heat. It is composed of thickened albumen, with small portions of gelatine and phosphate of lime. Horn when heated may be moulded into almost any shape, which it will keep when cold. The horns of the ox, cow, bison, buffalo, sheep, goat, and antelope are made into many highly ornamental and useful articles—such as handles for knives, forks, umbrellas, and walking-sticks; also into spoons, snuff-boxes, buttons, etc. Combs are made from flattened sheets of horn, which are got after the horn has been steeped in water for a considerable time.

Horn'bill. A bird of ungainly appearance, with large bill, helmet crowned, and found in India and Africa. By curious habit the male bird plasters the female in the hole of a hollow tree during nesting time.

Horn or French Horn. One of the most important of wind musical instruments, much used in orchestral music and in military bands. It gets its

name from the first horns having been made of the horns of animals. It produces a soft and peculiar tone, due to the length of the tube, which is coiled up into several rings, and has a large bell-shaped end.

Horn'blende. A tough mineral of black color,



THE HORNBILL.

due to a large percentage of oxide of iron. It forms part of several rocks, as trap, syenite, and hornblende slate, which is excellent for flagstone purposes.

Hor'net. An insect belonging to the Wasp family, but much larger and stronger than the ordinary wasp, and whose sting gives severe pain. It is fully an inch in length. It forms its nest of a kind of paper-work made from bits of wood and bark, which it places in hollow trees and walls. It feeds on fruits, honey, and insects. Hornets, like bees, live in societies made up of males, females, and workers. The females and workers do all the work, and sting when disturbed. Their sting inflicts a painful wound, usually accompanied with considerable swelling. The best applications for it are grated potatoes and sweet oil.

Horn'pipe. An instrument of music formerly very common in Wales. It is also the name of a characteristic lively British dance much in favor among sailors.

Horse. [AS. *hors*.] A beautiful animal, useful for carrying loads or drawing wagons. It is a most intelligent animal, knows its master well, and if kindly treated will always do its work

willingly and cheerfully. The horse belongs to the genus *Equus*, which contains several species, including the horse, the ass, the quagga, and the zebra. Horses in a wild state are found in many countries, and are very numerous in South America. Almost every country has its own breed of horses, which is generally suited to the climate. The horses of Iceland are small, with thick shaggy hair. The Arabian horse is much larger, and is one of the finest of all breeds. The Barbary horse of Northern Africa is much like the Arabian, but smaller. The British horse, from which the best horses in the United States have come, has much Arabian and Barb blood in it. It resembles the Arabian in appearance, but is much taller and longer. The best trotting-horses are found in the United States and in Canada. Draught horses, or horses used in drawing heavy loads, are reared in many countries. The Percheron breed, common in France, has been noted for hundreds of years. They are large, heavy horses, with large heads, and are much used for drawing business wagons. The principal parts of the body of a horse are—(1) the chest, (2) the withers, (3) the barrel, or part enclosed by the ribs, (4) the flanks, (5) the loins, and (6) the buttocks. The age of a horse may be ascertained from an inspection of its teeth. Horses sometimes live 30 years, but the average age is from 15 to 16 years.

Horse-chestnut. A large and ornamental tree, with large compound leaves, and bearing white flowers and a fruit or nut with a prickly shell. The nuts have a bitter taste, and are sometimes used as food for cattle. In some countries chestnuts are ground, and mixed with the food of horses; hence the name horse-chestnut. They are also made into a strong paste for bookbinders and shoemakers, and in France and Switzerland they are used in cleaning woollens and in the washing and bleaching of linen. The bark of the tree is sometimes used in tanning leather.

Horse-power or H.P. The power of lifting 33,000 lbs. weight one foot high in a minute; it is entitled *indicated* or *nominal*.

Horse-radish. A small plant with a stem about two feet high, but having a deeply-penetrating root, for which it is chiefly cultivated, and from which a highly valuable seasoning, of strongly acrid taste, is obtained.

Horse-shoe. A shoe for horses, consisting of a plate of iron of a circular form. Horse-shoes are necessary as a protection to the foot on stony or hard roads, and they vary in size, shape, and strength according to the formation of the foot and the kind of work the horse has to perform. They were formerly all made by the hand, and many still are, but machinery is now largely employed in their manufacture. Modern farriery requires light, small shoes, with few nails, and that the shoe be put on without overheating, which is cruel, and injures the horn.

Ho'siery. A name given to hose or stockings, and used now to include all kinds of knitted articles. Stocking-knitting was all done by the hand, until William Lee, of Woodbridge, in Nottinghamshire,

invented a knitting-frame. Many additions and improvements have since been made, so that now not only stockings and socks but nearly all articles of hosiery are made by a knitting-frame of one kind or other.

Hos'pital. [Fr., from L. *hospitalia*, apartments for strangers.] A building used for the reception of sick persons, or for those who are unable to supply their own wants. Some hospitals are set apart entirely for the treatment of those suffering from disease, others for incurables; some for the education of children, and others as homes for the poor and helpless. Naval and military hospitals are provided in all countries for the care of sailors and soldiers.

Hos'tage. [Fr. *Otage*.] A person left with an enemy or hostile power as a pledge to secure the performance of the articles or conditions of a treaty.

Hot-House. A building warmed by stoves or furnaces for rearing exotics or tender plants. A *hot-bed* is a garden bed covered with glass, to rear plants early in the season by the heat of the sun.

Hound. [AS.] A dog used for hunting. The bloodhound, staghound, and foxhound hunt only by scent, and may be termed true hounds. To this class may be added the harrier and the beagle; but the greyhound and the deerhound run by sight alone, and strictly speaking are not true hounds.

Hour. [Fr., from L. *hora*, an hour.] A space of time equal to 60 minutes, or to 1-24th part of a day. The hours of the civil day begin at midnight. Since 1885 the hours of the astronomical day begin at midnight, and are counted from 0 to 24.

Hour'-glass. A kind of chronometer or instrument for measuring intervals of time. It is constructed of glass, and consists of two bulbs, one above the other, connected by a narrow neck. The time is measured by the running of dry sand from the one bulb to the other, the quantity being adjusted to the time which each glass has been constructed to indicate. In the case of an hour-glass, as much sand is placed in one bulb as will take an hour to pass from it to the other. Hour-glasses were very much in use in churches during the 16th and 17th centuries, and specimens of very fine workmanship are still to be seen in several churches in England. (See *Log*.)

Huck'aback. A kind of linen with raised figures on it, used for table-cloths and towels.

Huck'leberry. A shrub of the Heath family which grows wild over most of the United States, and yields a palatable berry. There are several kinds, some being low bushes, while the swamp blueberry grows several feet high, and bears a much larger berry. The billberry is the same as the blueberry. (See *Whortleberry*.)

Hum'ble-bee. [Ger. *hummel*.] It is often called *bumble-bee*. (See *Bee*.)

Hum'ming-bird. The smallest and most beautiful of all birds, found only in America, and almost exclusively tropical. They get their name from the peculiar humming noise made by the rapid vibration of their wings. The muscles of their

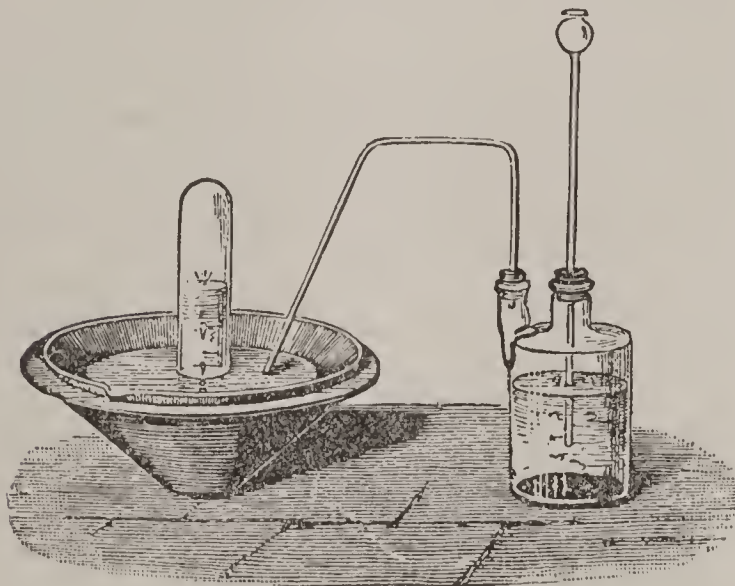
wings are very strong. This enables them to fly with great swiftness, and to hover over a flower while they capture the minute insects in it and perhaps sip the nectareous juices. They do not sing, having only a kind of shrill chirp. Their nests are very pretty, made of mosses and lichens, and lined with cotton and any soft thing they can find. They are unsurpassed by any birds for their brilliant plumage, and some are ornamented with crests, tufts, or frills. Many fruitless attempts have been made to domesticate these beautiful birds.

Hur'dle. [AS. *hyrdele*.] Twigs, osiers, and sticks woven together; a frame of split timber or sticks for gates and fences.

Hy'acinth. [Gk. *hyakinthos*, an iris.] A plant with a large rounded root and a beautiful flower of different colors.

Hydrau'lics. The science of fluids in motion. Of its applications may be named the hydraulic ram, which pumps water by the force derived from a moving stream; the hydraulic or hydrostatic press, in which the pressure of a column of water exerts a powerful force; and the hydraulic engine, which is operated by water pressure.

Hy'drogen. [Gk. *hydor*, water; and the root of *gennao*, to produce.] The lightest of the chemical elements. Hydrogen is a colorless and, when



HYDROGEN GENERATOR.

pure, tasteless gas. It is very inflammable, gives little light, but its flame is one of the hottest known. It is never found alone, but is always present in water. Pure hydrogen gas is about $14\frac{1}{2}$ times lighter than atmospheric air. It is generated by pouring dilute sulphuric acid upon zinc and collecting the gas in a receiver over water.

Hydrom'eter. [Gk. *hydor*, water; and *metrom*, a measure.] An instrument for measuring the weight of a liquid as compared with an equal amount of water.

Hye'na. [L. *hyena*.] A genus of carnivorous quadrupeds, about the size of a large dog, and of fierce and almost untamable character. The back and neck of the hyena are covered with coarse,

shaggy hair, forming a sort of mane. The hinder parts are lower than the fore parts, and it has a large head and ears. Hyenas live in caverns and rocky places, and at night prowl about in search of food, which generally consists of dead animals, but when very hungry whatever living



THE HYENA.

prey they can seize. The common or striped hyena is a native of Southern Asia, while the spotted hyena is found in Southern Africa.

Hydrop'athy. [Gr. *hydor*, water; and *paskein*, to suffer.] A mode of curing disease by the application of water. This is applied in various forms of the bath, also by enveloping the patient in a wet sheet. It has a bracing and tonic effect upon the system.

Hydropho'bia. [Gr. *hydor*, water; *fobos*, fear.] A disease caused by the bite of a rabid animal, and so called from the great dread which those who suffer from it have of water. Some doctors say that no such disease exists, the symptoms being due to fear and nervous excitement. Pasteur claims that it is a bacterial disease, and can be cured by inoculation with attenuated virus.

Hyp'notism. [Gr. *hypnos*, sleep.] The science of what was once called mesmerism and animal magnetism. The subject in a hypnotic state comes under the sole control of the operator, and acts under his suggestions, which seem reality to the patient. It is said that suggestions to perform a certain act at some future time will be obeyed, and in this way a criminal act might be done for which only the operator was responsible, the patient ceasing to be a free agent. Hypnotic suggestion is now used as a remedial agent, patients being induced to give up drinking, to cease other hurtful practices, to perform useful exercises or become diligent in study, etc. Also painful sensation is obviated, so that surgical operations can be performed without suffering.

I

Ice. [AS. *is, isa.*] Water freezes into ice when its temperature falls to the freezing-point, which is 32° on the Fahrenheit thermometer, and zero on the Centigrade. Ice forms on the surface of water, which expands in freezing—that is, any given quantity of water makes a larger volume of ice. The ice is therefore lighter than water, and this is the reason it floats. The expansion of water by freezing produces very remarkable effects on rocks and stones, splitting the rocks open and cracking the stones. Ice is found all the year round in the Polar regions, and on the tops of very high mountains. *Glaciers* are vast bodies of compressed snow and ice which move slowly down mountain sides. *Icebergs* are large masses which break away from glaciers on the Arctic coasts, and, falling into the water, float into warmer seas. Ice is now an important article of commerce, and is shipped in large quantities to warm countries, chiefly from the United States. Norway sends ice to Great Britain. Large quantities of ice are now made by freezing machines, in which cold is produced by chemical action.

Ichneu'mon. An animal of the Civet family, though it closely resembles the weasels in form and habits. It is about 18 inches long and very slender. It feeds on birds, rats, reptiles, etc., and, though destructive to poultry, is valued for its slaughter of snakes, and destruction of their eggs, of which it is very fond. It also digs up and sucks the crocodile's eggs, and on this account the Egyptians place it among their gods. *Ichneumon flies* are a family of insects which deposit their eggs in the bodies of other insects.

Igua'na. A reptile abundant in South America and the West Indies, of about 5 feet in length. It is of a green color with a bright yellow crest along the back. Though formidable in appearance, it is very timid, and is hunted for its delicate flesh, which tastes much like chicken.

In'cense. [L. *incensum.*] The perfume produced by the burning of spices and gums. It is the symbol of prayer in churches. The powder, made up of benzoin, storax, and other resins, cascarilla bark, etc., is placed in a silver vessel hung by chains. As it burns, the smoke escapes through little holes, and fills the church with sweet odors.

Inclined Plane. A sloping surface up which a weight can be pushed or rolled that could not be easily lifted. It is believed that the pyramids of Egypt were built by the use of great inclined planes, up which their heavy stones were dragged. It is now used on railroads in hilly countries and on many canals instead of locks, the boats being drawn up the sloping plane from one level to another.

In'cubator. [L. *Incubo.*] An apparatus for the artificial hatching of eggs, heat being applied instead of the natural warmth of the body. Several hundred eggs may be hatched in a single incubator.

India-rubber. The hardened juice of several kinds of trees. It is also known by the names *caoutchouc* and *elastic gum* or *resin*. The india-rubber of commerce comes chiefly from Mexico, South America, Madagascar, and the East Indies. The East Indian rubber is the juice of a kind of fig-tree, while the South American is that of the syringe-tree. A hole is made in the bark, and the juice is caught in a cup. It is pale yellow in color, and about as thick as cream, but when spread out it hardens and becomes nearly pure white. Previous to the beginning of this century india-rubber was used only for rubbing out pencil marks, but now its uses are very numerous. All kinds of elastic and waterproof goods are made from it. It is woven with silk, cotton, or woollen threads into a great number of fabrics. The discovery of the art of vulcanizing rubber by the addition of sulphur, which was made by Charles Good-year, an American, in 1839, has largely added to its uses. Tubes, fire-hose, and gas-pipes, elastic rings or bands, door and window springs, mats, boots and shoes, machinery belts, and many other useful things are made out of vulcanized rubber, which does not soften in hot weather like common rubber. Hard rubber or ebonite is made out of india-rubber and sulphur heated much hotter than vulcanized rubber. Canes, combs, backs of brushes, buttons, surgical instruments, picture-frames, knife handles, and a great variety of other things are made from ebonite. India-rubber mixed with sulphur and coal tar makes a substance so hard and black that it resembles jet. This may be cut and polished and made into bracelets, breast-pins, sleeve-buttons, studs, watch-guards, and other useful and ornamental things.

Indian Corn. (See Maize.)

Indian Summer. A term applied in the United States to the period of mild weather which nearly always comes at the close of October, extending sometimes to the middle of November. It is rainless and the atmosphere is apt to be hazy. In Europe a similar season is known as St. Martin's Summer.

In'digo. [L. *indicum*, from *India*.] A well-known and beautiful blue vegetable dye, obtained from the leaves of several species of plants which grow in the East and West Indies, India, Ceylon, Mexico, Brazil, Egypt, etc. Indigo is very extensively employed in dyeing and calico-printing. *White indigo*, discovered by Chevreul, results from the action of hydrogen on indigo. Indigo is made artificially in great quantities from *cinnamic acid* and *isatin*, which are derived from benzine.

Influen'za. An epidemic disease which comes suddenly, produces severe catarrh, and is very apt to develop into pneumonia or serious affections of other parts of the body. In France it is known as *la grippe*, which name has become common, and many occurrences of it are upon record, one of the most persistent of which

appeared in Europe and the United States in the winter of 1889-90, and was still active more than ten years later. The disease is believed to be of bacterial origin, and is often fatal.

Induc'tion. An important electrical phenomenon, in which a charged conductor causes unlike electricity to appear in an insulated conductor on the end near it, and like electricity on the other end. In the same way a magnet induces the opposite magnetic charge in iron, and an electric current induces a momentary current in the opposite direction in a neighboring wire. In practice, the induced current is often used instead of the primary current. In long telegraph wires and ocean cables induction acts to check the rapidity of movement of the current.

Ink. [Fr. *encre*.] A liquor or substance used for writing or printing. *Writing ink* is made of gall-nuts, sulphate of iron, gum, and water. *Copying ink* has more gum than writing ink; while *blue ink* is made of Prussian blue, oxalic acid, and water; and *red ink* is got from Brazil wood, but now generally from potassium eosin. *Black printing ink* is much thicker than writing ink, and is usually made of lamp black or ivory black mixed with burnt linseed oil.

Inlay'ing. The art of ornamenting flat surfaces with pieces of wood, ivory, pearl, precious metals, etc., by inserting them into spaces cut out of the body of the substance in which they are to be inlaid.

Insectiv'orous Plants. A name given to various plants whose leaves are developed into traps for catching insects, upon whose juices the plant seems to feed. Well known forms of these are the Venus fly-trap, the sundew, and pitcher plants.

In'sects. [L. *insectus*, cut into.] In point of

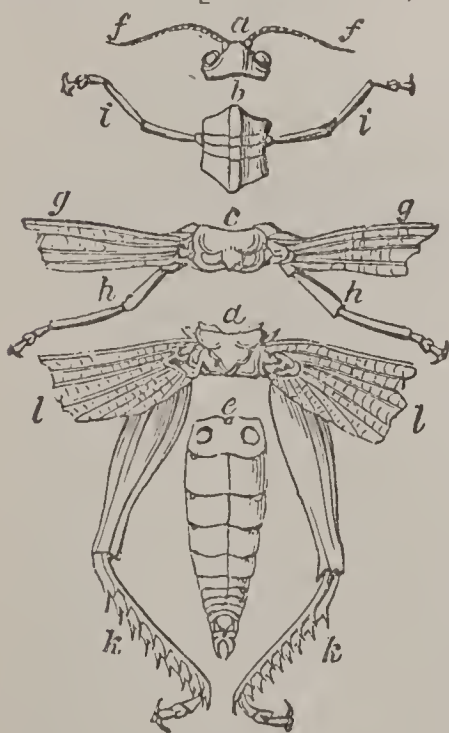


FIGURE SHOWING THE PARTS OF INSECTS.

a, head; *b c d*, thorax; *e* abdomen; *f f*, antennæ or feelers; *g g* ll, wings; *i i h h k k* legs.

number and variety of species by far the largest class of animals. The body, made up of a number of rings or segments, is divided into three parts—the head, forming one ring; the thorax, with three divisions; and the abdomen, with eleven rings. The head has two jointed feelers, called *antennæ*, which are used in smelling and as organs of touch and guidance, and three pairs of mouth appendages. The first pair, called *mandibles*, is used for cutting the food. Next come the first pair of *maxillæ*, and below these the second pair of *maxillæ*.

Insects feed on different kinds of food, some living on animal and some on vegetable substances, while others suck juices. Hence arises a difference in the shape of their mouths—some being formed for

biting and chewing, some only for sucking, and some for both. Three pairs of legs grow on the thorax, one pair on each ring; and they have usually either two or four wings also on the chest. The majority of insects are hatched from eggs, and these vary in number according to the kind of insect. Some kinds of insects, such as the hive-bee, the silk-moth, the cochineal and lac-insects, are very useful to man, other kinds, such as the locust, the grasshopper, the potato-bug, and many flies, are very harmful, destroying herbage and crops.

I'odine. [Gk. *ion*, a violet; and *eidos*, form.] A simple substance obtained from the ashes of seaweed; its vapor is of a rich violet color. Though an irritant poison, it is used medicinally in small doses.

Ipecacuan'ha. [Peruvian *ipi*, root; and *Cacuanah*, the district from which it was first obtained.] A plant found in the forests of Brazil, the root of which is used as an emetic.

I'ron. [AS. *iren*.] The most common and most important of all metals. Iron possesses properties so varied and useful as to give it the highest rank among the mineral productions of the earth. It is very hard and yet malleable; can bear a great strain or be made very brittle; is inflexible, but from it the most elastic springs can be made; it may be used for the heavy sides of a man-of-war, or the slender blade of a surgeon's knife.

Native-Iron. Of this there are two kinds:—1. *Telluric iron*, found in small grains in some basaltic rocks, and generally associated with other metals. 2. *Meteoric iron*—that is, masses of nearly pure iron which have fallen from outer space to the earth in the form of meteors. Some of these masses are of great weight, one found in 1871 near Disco Bay in Greenland weighing nearly 20 tons.

Iron Ores.—Iron is found chiefly in the earth's crust in combination with oxygen. There are several kinds of ores from which iron is made, but the most important are the various oxides, the carbonates, and the sulphides. From the two former almost all the iron of commerce is obtained. *Magnetic ore* is the richest of all the ores, and from it are made the finest iron and the best steel. It is found in large masses in Sweden, Norway, Russia, and North America, and in some parts of England. Some specimens of this ore form natural magnets. Magnetic ore when pure contains fully 72 per cent. of metallic iron. *Hematite ore* in its pure state contains about 70 per cent of iron. This ore is found in great abundance in Chili and other parts of South America, in Algeria, England, Norway, Sweden, and in large beds in Canada, Pennsylvania, Missouri, Michigan, Wisconsin and Wyoming. In addition to the ores mentioned there are many other kinds, such as *brown ore*, *bog ore* or *limonite*, *spathic ore*, etc.

Cast-iron, or pig-iron, as it is commonly called, is made by smelting or melting iron ore in a blast furnace. Iron smelting is necessary to free the ore from all foreign ingredients, to reduce

the iron oxide to metallic iron, and to allow the reduced iron to combine with such an amount of carbon as to form therewith a fusible compound. Cast iron is used for making gas and water pipes, lampposts, pillars and fronts for buildings, railings and many other things. It contains from 3 to 6 per cent. of carbon, and cannot be hammered, as it is brittle. To make it into *wrought iron*—that is, softer iron which can be hammered or rolled into plates—the cast iron is melted in another kind of furnace, and stirred up so that the air can get to it. In this way the carbon is burned out, and it contains only $\frac{1}{2}$ per cent. of carbon. Wrought iron is easily hammered into bars, rolled into plates, drawn out into wire, or made into *steel*. Iron plates for steam boilers and ships, anchors, chain cables, ploughs, wheel-tires, horseshoes, shovels and spades, nails and spikes, wire, the iron part of most tools, etc., are made from it. Pieces of wrought iron can be welded or joined into one by hammering them together when red hot. (See *Steel*.)

Irriga'tion. The watering of the earth to increase its fertility. The word is applied to flooding fields directly from streams, and to the digging of long canals and ditches to spread the waters of a stream over a broad section of land. It was practiced in very early times by the Egyptians and Babylonians, and is now much in use in many parts of the earth. It is being widely applied in the Western United States.

Isinglass or Fish-glue. [Corrupted from Du. *huizenblas*, the bladder of the sturgeon.] A substance consisting chiefly of gelatine, prepared from the sounds or air-bladders of certain fresh-water fishes. The finest is obtained from the sturgeon, which is very plentiful in the Caspian and Black seas and the rivers flowing into them; but isinglass is also made from the bladders of the cod and other fish, and quantities are produced in Brazil, North America, and the East Indies. It is much used in making jellies, ices and other kind of desserts, and in clarifying beer. It is the chief substance of Russian glue, noted for its strength, and used in stiffening linens, silks, gauzes, etc. Isinglass dissolved in acetic acid is a useful cement for repairing glass, pottery, etc.

Isother'mal. Having equal heat or temperature. Isothermal lines are those which pass through points of equal annual temperature upon the earth's surface. They are irregular in shape, the

temperature of a place being not closely governed by its latitude. Thus in passing from western Europe to eastern America the lines may differ 10 or 11 degrees in latitude. In crossing the United States they reach higher latitudes on the Pacific than on the Atlantic coast.

I'vory. [Fr., from L. *ebur*, ivory.] The hard, fine-grained substance of a fine white color obtained from the tusks and teeth of the elephant. The name is also given to the tusks and teeth of certain other animals, as the hippopotamus, walrus, narwhal, etc. The tusks of the African elephant yield the best ivory, on account of their superior density and whiteness. They are of all sizes, but the largest weigh from 180 to 200 lbs. Indian and Ceylon elephants also yield much ivory, but the ivory used by Russian ivory-workers is that of mammoths found buried in the soil of Northern Siberia. Ivory is used in the manufacture of knife-handles, billiard balls, chess-men, dice, fans, combs, paper-knives, napkin-rings, brooches, organ and pianoforte keys, etc. Great taste and skill are often shown in working ivory, and some of the carved boxes, ornaments, and toys made of it are very beautiful. The Chinese and Japanese are very skilful in carving ivory. Ivory obtained from the hippopotamus is very white, and not grained like that of the elephant, and is used by dentists for making artificial teeth.

Vegetable ivory is the nut of a palm-like tree which grows on the plains of Peru, and on the banks of many of the rivers of South America. The nuts, about the size of hens' eggs, are exceedingly hard and white when ripe, and resemble ivory so much that they are used in the manufacture of buttons, umbrella handles, and small trinkets.

I'vy. [AS. *ifig*.] An evergreen plant of the genus *Hedera*, which creeps along the ground or climbs trees, rocks, walls, etc. Its leaves are very pretty, of a dark-green color, smooth and shiny. It is found almost throughout the whole of Europe, and especially in Great Britain. In North America it does not succeed very well, but on the Pacific coast it grows luxuriantly, and it is popular in Virginia and some of the Southern States. Various substances are got from the different parts of the plant. The stem yields a gum resin and the seeds a bitter substance called *hederin*. *Poison ivy* is a poisonous, climbing plant of the Sumach family. It is common on trees, etc.

J

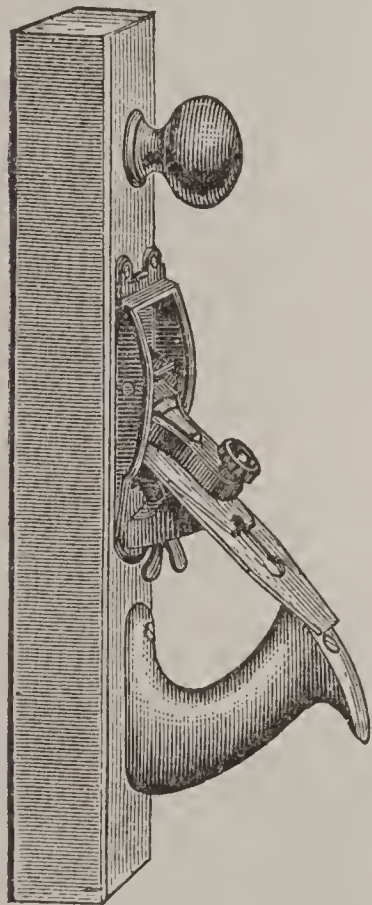
Jack. A hoisting or lifting device, consisting of a screw arrangement by which a heavy weight may be lifted with small power. The hydraulic jack is the most powerful of lifting machines. In its use water is forced through a small hole into a chamber of considerable dimensions. By its aid a man may lift 10 tons 1 foot in a minute and a half, or 100 tons in 15 minutes. The term jack is applied to many other tools used in the arts.

Jack'al. This animal belongs to the genus *Canis*, and has a close resemblance to the dog and the fox. The common jackal is of a grayish-yellow color, about 3 feet in length and 14 inches in height, with short ears and small eyes. Jackals sleep during the day in holes and burrows, and go out at night to hunt in packs, sometimes more than a hundred together. They keep up a constant howling, making the night hideous in the

regions where they abound. Their food consists chiefly of carrion and decaying matter, but they also enter houses or tents, and are the pests of the poultryyard. The common jackal is found in Africa, from Barbary southwards to the Cape of Good Hope, and in Persia, Syria, and the southern regions of Asia. The striped jackal, the jackal-wolf, and the black-backed jackal are different species, all found in Africa.

Jack'daw. [*Jack* and *daw*.] A bird of the crow kind, smaller than the rook and carrion crow, in length about 12 inches. Its plumage is of a glossy black, and it has a short black bill and black legs. It is common in the British Islands, and is found over nearly all Europe, also in Asia and the north of Africa, but not in America. It builds its nest in cliffs, ruins, towers, and elevated situations, and in chimneys and in hollow trees. Its food consists of worms, snails, and insects. Jackdaws lay from five to six eggs of a greenish color, covered with small dark-brown spots. They are easily domesticated, and soon become familiar and imitate the human voice.

Jack Plane. A Carpenter's cutting and surface smoothing tool, from 12 to 17 inches in length and used to take off the roughest surface of the board.



JACK PLANE.

Jac'onet. A light soft muslin, used for dresses neckcloths, etc.

Jade. [Span. *ijada*, flank.] A mineral, called also *oxstone*, of a greenish color, compact, and with a fatty lustre. It was believed to cure pain of the *side*, hence its name. Chinese jade is wrought into beautiful vases and other objects.

Jag'uar. A large and ferocious animal, of the cat family, found chiefly in South America, and often called the American tiger. It is found in North America as far north as the borders of Texas. It is larger than the leopard and is very strong. Its fur is of a brownish-

yellow color, beautifully marked with dark ring-like spots, each ring enclosing several small black points. It resembles the leopard in color and general appearance, and, like it, can climb trees with great ease. The jaguar lives in thick forests near large rivers and lakes. Wild horses and mules are its favorite prey, and it feeds on turtles. South Americans hunt the jaguar in various ways, but chiefly with the aid of dogs and the *lasso*. Jaguar skins are very handsome, and are largely imported into Europe, and made into valuable robes, etc. It will not attack man unless impelled by hunger, or self-defense.

Jal'ap or Julep. [So called from *Jalapa* in Mexico.] (*Rose-water*.) The root of a plant much used in medicine as a purgative.

Japan'ning. The art of covering wood, metal, leather, paper, etc., with a thick coating of colored varnish. It was first practised by the Japanese, hence the name. Tea-trays, tin canisters, cash-boxes, coal-boxes, etc., are japanned in iron and tin works in large cities.

Jas'mine. A genus of long twining shrubs, bearing sweetly-scented flowers.

Jas'per. [Gk. *iaspis*.] A hard precious stone of various colors (usually red or brown), which takes on a high polish, and is used for rings, seals, vases, and other ornaments, and also for the decoration of costly buildings. It is one of the varieties of quartz, and is found in veins and embedded masses in many rocks.

Jaun'dice. [Fr. *jaunisse*.] A disorder of the liver, causing bile to mix with the blood, when the skin becomes yellow.

Jay. (*Garrulus*.) A genus of short-winged birds of the Crow family. The jay frightens small birds with its cry, and robs nests of their eggs. The European jay is of a yellowish-brown color, and resembles an ordinary pigeon in size. Its food consists chiefly of berries, seeds, fruits, and nuts, but it is also fond of worms, insects, and young mice. The American jay, or blue jay, has a far more brilliant plumage than the European jay, with a crest of feathers. The Florida jay is blue. The Canada jay is plain colored, and without a crest.

Jel'ly. A translucent juice which thickens when cold into a soft and trembling mass. The juice of currants and some other fruits thickens to jelly after boiling with sugar. A jelly is also made from Iceland moss, and there are various jellies made from animal substances,—as calves' foot jelly.

Jel'ly=fish. (*Medusæ*.) Soft-bodied ocean animals, which form a disk of an umbrella-shape, with a mouth in its centre, opening downwards, and long tentacles surrounding the mouth or depending from the margin of the disk. They have stinging powers, and move by opening and shutting the umbrella disk. Their flesh resembles jelly, some of them being small and transparent, others quite large.

Jer'boa or Jumping Mouse. (*Dipus*.) A genus of rodent mammals allied to the mouse, having very short fore legs and remarkably long hind ones, and noted for their power of jumping by the aid of a long muscular tail. The average length of the body is about 8 inches, the tail often measuring 10 inches. They are common in Asia and Northern Africa, and a few species are found in Russia and North America. They live in burrows, are nocturnal in their habits, and hibernate.

Jeru'salem=ar'tichoke. [*Jerusalem*, corruption of Ital. *girasole*, or sunflower.] A plant whose root is sometimes used for food.

Jet. [From *Gagas*, a town in Asia Minor.] A hard black mineral, easily cut and carved, and capable of receiving a very beautiful polish. Jet

appears to be a kind of bituminous coal, but much harder and smoother than that used for burning. Much of it is found near Whitby, Yorkshire, where it has been worked for centuries. It is made into buttons, mantel ornaments, necklaces, earrings, brooches, bracelets, and other trinkets. Jet is also found in France and Spain, and in these countries it is made into rosary beads, crosses, etc. Sometimes called *black amber*.

Jet'ty. A landing-place carried out so far that vessels may discharge their cargoes at all states of the tide; a breakwater for the protection of river or harbor mouths. Jetties are built out in pairs into the ocean so as to confine the outflow



JERBOA OR JUMPING MICE.

of streams and prevent the formation of bars. The Mississippi jetties, begun in 1875, deepened the South Pass of that stream from 14½ to 23 feet, the confined water sweeping the mud from the bottom.

Jew'el. [Fr.] Any ornament of precious stone, metal, or other valuable material. A diamond or other stone in a watch on which the pivot turns.

Jew's=harp. A simple instrument of music, made of metal, and shaped like a harp. When played it is placed between the teeth, and by means of a little spring, which is made to vibrate by being struck with the finger, it produces a sound which is modulated by the breath of the performer into soft melody. Also called *Jew's-trump*.

Johan'nisberger. The finest kind of Rhine wine, made at Johannisberg monastery.

John=dory. [John, and Fr. *dorer*, to gild.] A flat sea-fish of a golden-yellow color, with a

small round spot on each side; hence called *St. Peter's Fish*.

Joists. [Fr., to lie.] Pieces of timber, laid horizontally in parallel rows, resting on walls and girders, and sometimes on both, and to which the boards of a floor or the laths of a ceiling are nailed.

Jol'ly=boat. A small boat belonging to a ship.

Jour'nal. [Fr. *journal*.] A diary; a book containing an account of daily transactions and events; a *business* book in which every particular article or charge is entered; a paper published daily or at regular times.

Ju'jube. The name of a small tree or shrub and of its fruit, sometimes called lotus. The tree is a native of Syria, and is now cultivated in many parts of Asia and in Europe, chiefly for its fruit, which is dried as a sweetmeat. The common jujube paste is really a mixture of gum arabic and sugar, slightly colored.

Ju'niper. [L. *juniperus*.] A hardy evergreen tree or shrub, with dark-purple berries, which have a strong and peculiar flavor, and are much used for flavoring gin. The common juniper is found in Europe, the north of Asia, and the northern parts of North America. It attains no great height, being in general only a shrub from 2 to 6 feet high, but in favorable circumstances it becomes a tree from 15 to 30 feet in height. The fruit takes two years to ripen. *Virginian juniper*, or the red cedar of North America, attains a height of from 30 to 50 feet; and the wood, which is of a beautiful red color, is highly prized by turners, and is also largely used for cigar-boxes and lead pencils.

Ju'piter. The largest planet of the solar system. It is about 88,000 miles diameter, eleven times that of the earth, and rotates in less than 10 hours, its surface at the equator moving 28 times as fast as the earth's surface. Its distance from the sun is 485,000,000 miles.

Jute. The fibre of the inner bark of two plants, which are very extensively cultivated in India, especially in Bengal. Both plants are annuals, in height from 10 to 14 feet, with yellow flowers and smooth leaves. The stem is erect, smooth, and cylindrical, and the inner bark is separated from it by steeping in water. The fibre is of a yellow or buff color, comparatively strong, easily spun, and possessing a shining surface. It is largely used for making coarse cloth for bagging and sacks, and in the manufacture of carpets, tarpaulin, backings for floorcloth, manilla paper, etc. Jute has been woven into various fabrics in Bengal from a remote period, and there are now many jute factories in India. (See *Gunny*.)

K

Kalei'doscope. [Gk. *kalos*, beautiful; *eidos*, a form; and *skopein*, to see.] An optical instrument invented by Sir David Brewster in 1817. It consists of a tube containing two glass mirrors, making an angle of 60° with one another, and

extending the whole length of the tube. One end of the tube has a small opening to serve as an eye-glass, and the other end has two glasses, one of ground and the other of clear glass, with little pieces of colored glass lying loosely between

them. These colored bits of glass are reflected in the looking-glasses, and regular figures of the most beautiful form, which change whenever the instrument is shaken, are seen on looking through the instrument. It forms a cheap and pretty toy, and is also used, in a more expensive form, by pattern-drawers and others, who get from it an endless variety of designs.

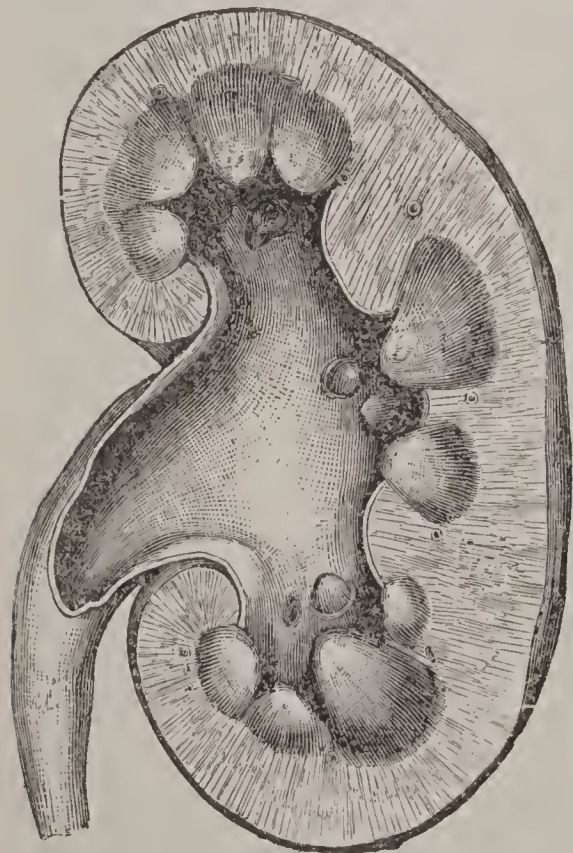
Kan'garoo. An animal belonging to the Marsupial order of mammals, and found only in Australia, New Guinea, and the neighboring islands. Its distinguishing features are very short fore legs, which are not used for walking, remarkably long hind legs, by means of which it makes long leaps, and a pouch in which it carries its young for a certain period after birth. The kangaroo has a long, thick, and strong tail, and when resting and feeding it supports itself on its hind legs and its tail. Kangaroos live on vegetable food, mainly grass, which they consume in large quantities, two kangaroos eating as much grass as three sheep. They are hunted in various ways, chiefly by dogs, upon which they turn and strike heavy blows with their tails. The skin is much prized, and makes a valuable leather for shoes and gloves; and the flesh is largely eaten by the natives in Australia, and is said to be nutritious and to resemble mutton.

Ka'olin. A pure white clay, resulting from the decomposition of felspar in granite rocks. The finer kinds of porcelain are made from it.

Kelp. A dark-gray powder or ash, got by burning seaweed, used chiefly in the manufacture of iodine, and formerly of glass.

Kes'trel. A small bird of the genus *Falco* or hawk kind, like the sparrow-hawk.

Kid'neys. Two peculiarly shaped glands which



secrete the urine from the blood and send it into the bladder. In the human body they are situated one on each side of the abdominal cavity, and are spoken of as the right and left kidney. Their average length is fully 4 inches, and they weigh from 4 to 6 ounces each.

Kin'dergar-ten. [Ger. *kind-er*, children; and *garten*, a garden.] A school or training-place for

young children, in which instruction is given by means of games and other amusements; so called because first carried on in rooms opening on a

garden. The system was devised by Friedrich Froebel in 1826. Since that time it has been gradually developing and extending.

Kine'toscope. An apparatus for taking and afterwards exhibiting a rapid series of photographs of moving scenes. By its use life-like pictures can be displayed. Various names have been given to modifications of this instrument, as Biograph, Vitascope, Mutoscope, etc., all based on the one principle.

King'bird. Also known as the Tyrant Fly-catcher and Bel-martin. It is found only in America east of the Rocky Mountains, and during the nesting season is very fierce. It will attack the largest bird that comes too near its nest, even eagles and hawks being driven off by this little tyrant. It will dart upward, alight on the back of its enemy, and with its sharp beak make him suffer for his temerity.

King'fisher. A genus of perching birds noted for their brilliant plumage. The kingfisher is usually found alone, perched on the bough of a tree on the banks of rivers. Here it will sit for hours watching for fish. It dives the moment it perceives its prey, carries the fish to the perch, kills it, and swallows it whole. The kingfisher makes its nest of fish-bones, ejected by the bird itself. It is found all over the world. The wood kingfisher of Africa feeds largely upon insects, snails, and fishes. The belted kingfisher of North America is slate-blue, with white breast, and feeds on fishes. The giant kingfisher of Australia feeds on lizards and insects.

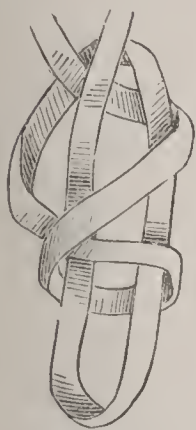
Kite. [AS. *cyta*.] The name of a very active bird of the genus *Falco* or hawk. Its bill is short and strong, its wings are long, powerful, and pointed, and its tail is forked. The kite spends the greater part of the day on the wing, sometimes flying so high that it can scarcely be seen, and coming down at night to roost on tall trees. When in the air it lives mostly on insects, but its food consists also of moles, mice and carrion. The common kite and the black kite are found throughout Europe; the swallow-tailed kite is common in America. The carrion-feeding habits of this bird are seen to perfection in the birds found in Asia, and particularly in India.

Kite. A light frame of wood and paper constructed for flying in the air, chiefly for amusement. Kites get their name from the kind of hawk called kite, which has just been described, and which is often seen in the air, almost as still as a paper kite, gliding along without moving its wings. Kites are made of many different shapes, but the most common are the cross-kite, the house-kite, and the bow-kite. The natives of India, the Chinese, and the Japanese are very skilful in making kites, and often make them to represent animals, ships, castles, trees, and flowers. Kites are used to carry lines across deep chasms or over the tops of steeples and high chimneys, and are now employed in the study of the weather, being sent very high into the air.

Kit'tiwake. A bird of the gull kind.

Knife. [AS. *cnif*.] Primitive men used shells, flints, and sharp-edged stones for knives. These

were followed by bronze knives made of copper and tin; but knives made of iron and steel gradually took their place, as they were found to be more lasting and stronger. The best knives are now made of steel. In the manufacture of table-knives a bar of shear-steel is heated white



CROSSED SLIP-KNOTS,

hot and then hammered into shape on an anvil. This is called forging the blade. Penknife and razor-blades are made of cast steel. After forging, the blades are stamped with the maker's name, and then tempered by heating them red hot and cooling them quickly by dipping them in water. They are then ground and polished and fitted with handles.

Knight. A title of honor, originally adopted during the feudal system, and given to soldiers of courage and experience. The knight took the title of Sir before his name. Knighthood was conferred of old by laying the blade of a sword on the shoulder of the one to be honored and repeating a formula declaring him a knight. There were several Orders of Knighthood. Knighthood is now a civil, not a military, rank.

Knot. In nautical language a division of the log-line serving to measure the rate of a vessel's motion. The log-line is divided by knots into

sections, and the number of sections which run off in half a minute show the number of geographical miles or knots per hour at which the vessel is going. A geographical mile or knot is 6,086 feet, while an English statute mile is 5,280 feet. (See *Log*.)

Knots. There is an almost endless variety of knots, most of them in use on board ship, though different occupations using ropes, cordage, etc. have special kinds of knots. Knots used by sailors differ in form, size, and name according to their varied uses; as the diamond-knot, over-



SAILORS-KNOT.

hand-knot, bowline-knot, buoyrope-knot, reef-knot, shroud-knot, stopper-knot, etc.

Ko'dak. A form of photographic camera adapted to take instantaneous negatives by the "snapshot" process. It is made in the form of a small box, with a lens and shutter on one side, and a reflector on top to aid the operator. The negative is taken by pressing a button, which opens the shutter for an instant. (See *Camera*.)

Kou'miss. A fermented drink made from mare's milk originally, though it may be made from the milk of any animal. The article usually sold under this name is made from cow's milk, yeast being used to cause it to ferment. It is esteemed a nutritious beverage and an aid to digestion.

L

La'bel. A narrow slip of silk, paper, metal, or parchment, containing a name or title, and affixed to anything, to tell what or whose the thing is.

Labur'num. A small tree, a native of the Alps, much planted in shrubberies and pleasure-grounds on account of its glossy leaves and clusters of beautiful yellow flowers. The laburnum is a very hardy tree, and though of rapid growth its wood is hard, fine-grained, and very durable, and is highly valued by cabinetmakers and turners. It is used also for wedges, pulleys, pegs, bows, handles of knives, and other instruments. The seeds are poisonous.

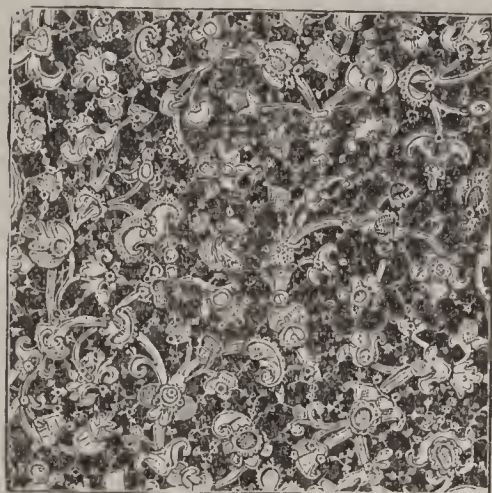
Lab'yrinth. A building or ground space full of winding passages, which are very difficult to traverse. There were three famous ones in ancient history. One at Arsinoë in Egypt had 3,000, apartments, half of them underground. There was a similar one in Lemnos, and a smaller but famous one in Crete—though this is traditional and its existence doubtful.

Lac. A resinous substance found on certain trees in different parts of the East Indies. It is produced by punctures made by a very small insect called *Coccus lacca*. These insects live on the sap of the trees, and soon become fixed to the branches by the juices which ooze out. The twigs containing the deposit are broken off, and form the *stick-lac* of commerce. *Seed-lac* is the

deposit broken off from the twigs, while *shell-lac* is obtained by placing the twigs in hot water, which melts off the gum. It is then purified by straining through cotton bags, and dried on strips of wood. The water in which the lac has been melted is colored red by the bodies of the insects, and after the melted lac is taken out this water is strained and evaporated, and the sediment is cut up into small cakes and sold as *lac-dye*. Lac-dye is largely used in dyeing silk and wool. Shell-lac is used in the manufacture of hats to stiffen the calico frame, and in making sealing-wax and different kinds of varnish—"Lac" is the same as the numeral lakh—a hundred thousand—and is indicative of the countless hosts of the lac insects.

Lace. [Fr., from *L. laqueus*, a noose.] A fabric formed of threads of cotton, wool, flax, silk, silver, or gold, used chiefly for ornamenting dresses. Lace is made either by hand or machine. To that made by the hand the term real lace is sometimes applied, and also pillow or bobbin lace, from being woven upon a pillow or cushion by means of bobbins. Much of the lace now used is made by machinery, the machines at present in use being modifications and improvements on the bobbinet machine invented by Mr. Heathcote of Tiverton in 1809. Nottingham in England, and Alençon, Brussels, Mechlin, and Valenciennes are centres of this industry.

Lac'quer. [From *lac*, a gum or resin.] A varnish composed of shell-lac dissolved in alcohol with gamboge, and used for coating metals, chiefly polished brass, to which it gives a golden bronze color, preserves their lustre, and secures them against rust. The name is also given to a varnish made by the Japanese and Chinese from



LACE.

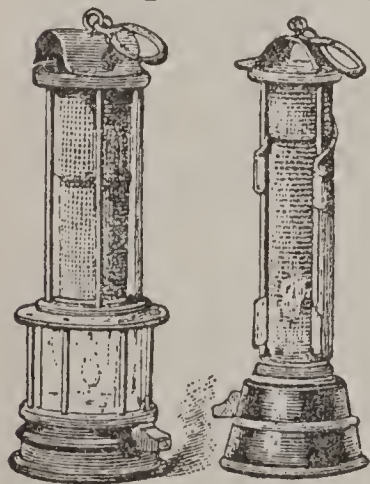
the juice of the laquer or varnish tree found in these countries. *Lacquer-ware* consist of various articles, such as boxes, trays, cabinets, etc., many of them decorated by inlaying, gilding with gold or silver, designs in color, or carving.

The Japanese and Chinese excel in this work, and give the articles a beautiful finish.

Lacrosse'. [Fr. *la crosse*, the hooked stick.] A game of ball, first played by the North American Indians, now common in Canada.

Lady=bird. (*Coccinella*.) A small kind of beetle of a brilliant red, orange, or yellow color, with black spots, or sometimes black with white, yellow, or red spots. It lays its eggs in little collections under the leaves of plants, among the plant-lice, on which both the larvæ and the full-grown insects feed.

Lamp. [Gk. *lampas*.] A vessel used for giving light by means of a wick dipped in oil and lighted. In ancient times lamps were simply flat vessels made of earthenware or stone. Specimens of these have been found in the ruins of Pompeii and Herculaneum. In later times they appear to have been formed from various metals, more particularly bronze. Lamps are now made to give an excellent light, and are also used for heating and cooking. Rushes, animal fats, and



CLANNY LAMP. DAVY LAMP.

fish oils were first used for burning in lamps. These were followed by vegetable oils, which in turn have been largely superseded by mineral oils, such as paraffin, petroleum, kerosene, crystal and mineral sperm. The *safety-lamp* invented by Sir Humphrey Davy in 1815 is of great use in mining. It is covered with wire gauze, and gives the miner sufficient light without the danger of setting fire to inflammable gases. *Arclamps*

and *incandescent lamps* are devices for producing light by electricity.

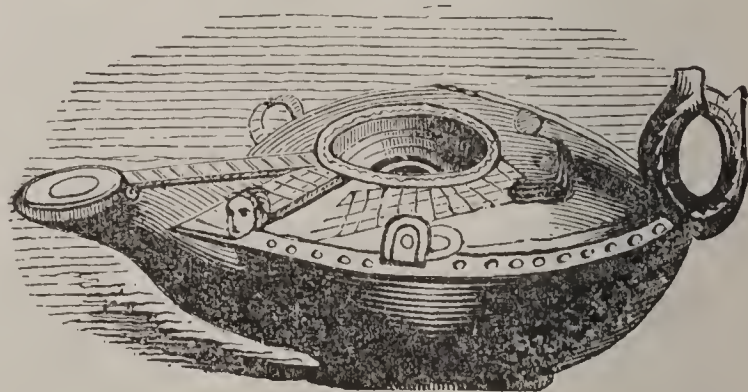
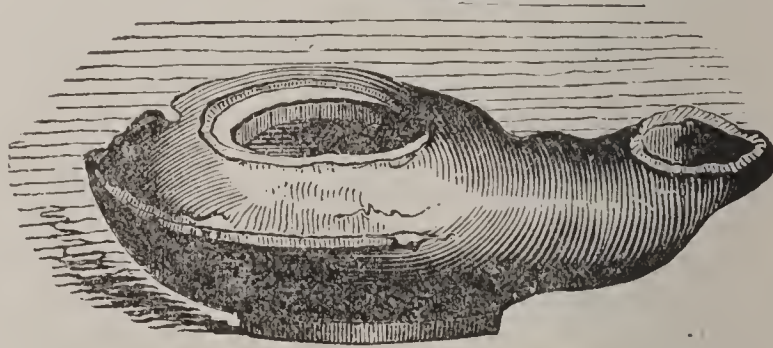
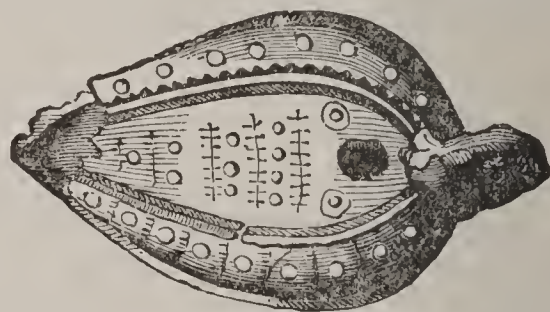
Lamp'black. A fine soot formed by burning resin, petroleum, pitch, tar, and oils and fats in close iron vessels. During combustion the dense smoke

passes into a chamber covered with a coarse woolen cloth, and a thick coating of lampblack is soon formed, which is shaken off and put up in barrels for sale. Lampblack is used by artists and painters, and is the chief ingredient in China ink and printing ink.

Lam'prey or Rock-sucker. A species of fish somewhat resembling the eel in form. Its body is destitute of the paired fins found in most other fishes, is without scales, and covered with a glutinous mucus. The mouth is circular in form, and by it and the tongue, which acts like a piston, the animal attaches itself firmly to fixed objects. Formerly the lamprey was highly esteemed as an article of food, and even of luxury, but is not so commonly used now.

Lance. [*L. lancea*.] A weapon much used by the ancients, consisting of a long shaft with a sharp point. It was an important weapon of war in the Middle Ages, and though now differing in form is still used by European cavalry. Lances are now made of ash or beech wood, about 12 feet long, with a steel point 8 or 10 inches long. Near the point is a small flag, intended to frighten the horses of the enemy. When not in use the lance is carried in a leathern shoe by the right stirrup, a leathern thong on the right arm keeping it in position. In use it is carried under the right arm.

Lancewood. The wood of a tree found in the West Indies, chiefly in Jamaica, of which it is a



ANCIENT LAMPS.

native, and possessing great toughness and elasticity. It is used by coach-builders for shafts and carriage poles.

Land-crab. Land-dwelling crabs, of which there are many species. The Black or Mountain Crab of the West Indies lives from one to three miles from the sea, to which it travels, in immense numbers, in April or May, for the purpose of laying its eggs. It is chiefly active at night.

Lapis Laz'uli. [L., azure stone.] The name of a mineral of a rich blue color, consisting chiefly of silica and alumina, with sulphates of soda, and iron in spots or veins. It is found in Persia, China, Chili, and Siberia, and is used for ornamental purposes, especially for inlaid work. In the marble palace built by the Empress Catherine at St. Petersburg there are entire apartments inlaid with lapis lazuli. It was much esteemed by the ancients, who used it for engraving and for vases.

Lap'wing. A bird of the Plover family, with long, broad wings, which from their regular, slow flapping have gained for it the title Lapwing. It is also known by the name *Peewit*, from its peculiar cry. Lapwings are common in Britain all the year, and are also widely distributed in Europe and Asia. They frequent marshy pastures, feed on worms, slugs, and insects, and are hunted for their flesh. Their eggs, which are known as plovers' eggs, are highly esteemed, and fetch good prices in the British markets.

Larch. [L. *larix*.] A cone-bearing tree, common in Europe, Asia, and North America. The European larch attains a height of from 60 to 100 feet, with a trunk of from 3 to 4 feet in diameter. The larch grows rapidly, and is considered to be fit for every useful purpose in forty years' growth. The wood is compact and strong, of a reddish or brown tinge, and is used for railway sleepers, hop-poles, scaffold-poles, and for ship-building. The bark is used for tanning leather. The American larch, or hackmatack, or tamarack, as it is sometimes called, is a slender tree, but its wood is heavy and cross-grained, and highly valued for ship-building and for railway ties.

Lard. [Fr. *lard*.] The fat of the hog after being separated from the flesh and melted. It is largely used for culinary purposes. Lard consists chiefly

of stearin, which is a solid and olein, which is a liquid fat. The former is used in candlemaking, and the latter as a valuable lubricant for machinery.

Lark. [AS. *laferc* or *lave-rock*.] A well-known bird of the family *Al-*



auda. The best-known species is the skylark, a familiar songster, remarkable as one of the very few birds which sing freely while on the wing. It begins to sing when it rises from the ground, and though its notes are feeble and interrupted at first,

they swell out to their full tone as the songster ascends, and may be heard long after the bird has passed from the range of vision. The larks may be considered as especially birds of the fields and meadows, the nest being made of dry grass, in a hollow in the ground.

Lar'ynx. [Gk. *larynx*.] The upper part of the windpipe or trachea forming the organ of voice. It is situated between the windpipe and the base of the tongue, at the upper and front part of the neck, and opens above into the throat (*q. v.*), and below into the windpipe. The skeleton of the larynx is composed of five principal cartilages, and these are connected by ligaments known as vocal cords, the movements of the organ being regulated by two sets of muscles.

Las'so. [Span. *lazo*.] A rope or long thong of leather with a running noose, used for catching horses, cattle, etc.

Lathe. A machine by which wood, ivory, metals, and other materials are turned and cut as they revolve by a tool held in the hand or fixed in a slide-rest. All the rounded parts of furniture, such as legs of tables, chairs, and stools, the balusters of staircases, tool handles, round rulers, etc., are made on the lathe. Billiard balls and chess-men, and all the round parts of engines and other machines, are made on various kinds of lathes. Articles of irregular form, such as the stocks of guns and pistols, and hollow things, such as wooden bowls and dishes, bread platters and boxes, are also made on the turning-lathe.

Laths. The name given to thin, narrow strips of wood, rarely longer than four feet, used for nailing to the uprights of partition walls, and to the rafters of ceilings. They are placed slightly apart to receive the plaster, which, by being pressed into the spaces, is held firmly when it dries. Laths are now mostly sawn by machinery from Baltic fir or Canadian deal.

Lat'itude. Distance from the equator north or south towards the poles. Lines of latitude are imaginary lines which surround the earth, parallel to the equator, diminishing in length until they reach the poles, where they vanish.

Lat'tice. [Fr. *lattis*, lath-work.] Any work made by crossing laths, rods, or bars of wood or iron, and forming open squares like network; a window made in this way.

Lau'rel. [L. *laurus*.] The name given to a genus of plants, consisting of trees and shrubs, whose leaves and fruit are bitter, astringent, and aromatic, and were formerly much used in medicine. Laurel or bay leaves are now used for flavoring in cookery. The laurel or sweet bay is a small evergreen tree, found in the south of Europe and north of Africa. It has beautiful glossy leaves, and bears black berries about the size of wild cherries. This laurel is celebrated by poets, and used to decorate temples and the brows of victors. The victors in the Pythian games were crowned with the laurels of Apollo, and thus the laurel became the symbol of triumph in Greece and then in Rome. The American laurel is found almost all over the United States,

growing chiefly on rocky hillsides. Its wood is hard and fine-grained, and is used by turners for making chisel handles.

La'va. [It. *lava*.] The name given to the melted matter which bursts or is thrown from the mouth of a volcano. It flows like melted glass or iron down the sides of the mountain, but speedily cools and hardens into a porous mass. Ancient lavas form extensive rock strata in some localities, as in the western United States.

Lav'ender. (*Lavandula*.) A delightfully fragrant plant, much used in making perfumes. The leaves and flowers of lavender are said to have been used by the ancients to perfume their baths; hence the name *Lavandula* may be derived from *lavare*, to wash. The common lavender grows wild on stony mountains and hills in the south of Europe, and is largely cultivated in gardens in Surrey in England and near Philadelphia. The flowers of the lavender are often put into wardrobes to keep away moths. *Oil of lavender*, largely used in medicine, is made by distilling the flowers with water; and *Lavender water*, one of the most popular of all perfumes, is obtained by dissolving oil of lavender with smaller quantities of spirit and rose-water.

Lawn Tennis. A favorite ball game, played on a smooth surface divided by a net. The ball is sent by use of a racket, effort being made to return it over the net as often as possible.

Lead. [AS. *læd*.] A well-known metal of a bluish-white color, very heavy, easily melted and cut, and which may be hammered or rolled out into sheets and drawn into wire. It has been used from very early times, and articles made of it by the ancient Romans—such as water-pipes, water-tanks, weights, rings, etc.—have been found. Lead is soft, highly malleable, and a poor conductor of heat or electricity. It is largely used for water-pipes and cisterns, and for covering the roofs and gutters of houses. Lead is found in a large number of minerals, though often in very small quantities. Most of the lead now in use is obtained from the ore called galena or sulphide of lead. This ore is found in many parts of the world, but the purest veins are got in Great Britain, Germany, Spain, and the United States. The process of smelting the galena ore to get the pure lead differs from that of smelting iron ore, and is done in an entirely different kind of furnace. *Sheet lead* is made by rolling slabs of lead between heavy iron rollers until they are thin. Thick sheets are used for lining tanks and water cisterns, and for covering roofs, and thin sheets for wrapping up snuff, lining tea-chests, etc. Lead is used in alloy with other metals—forming, when mixed with arsenic, the alloy from which shot is made; with tin, pewter and solder; and with antimony, type-metal. Lead and its compounds are poisonous.

Leaf. A flat, expanded organ of a plant, varying in shape, and situated usually at the extremity of the twigs. It is employed in elaborating the plant food. The crude sap enters the leaf, where

it receives carbon from the carbonic acid of the air. This changes the character of the sap and adapts it to serve as plant food.

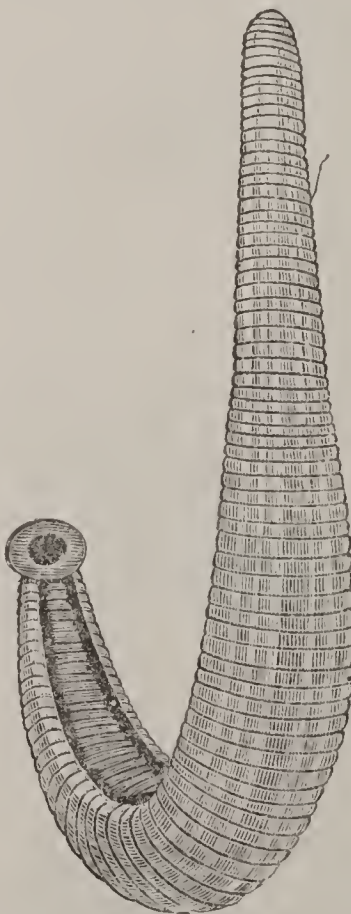
League. [L. *leuca*, a Gallic mile.] A measure of distance of ancient origin. The Roman league was equal to 1,500 paces, each of 5 feet. The league is used as a nautical measure, and signifies the 1-20th part of a degree—3 geographical miles, or 3.45 English statute miles. The land-league is approximately 3 statute miles. Its length varies in different countries.

Leather. [AS. *lether*.] The hides or skins of animals dressed and prepared for use by tanning and otherwise. The most important leather-making hides are those of oxen, but various kinds of leather are made from buffalo and horse hides, from the skins of sheep, goats, kids, hogs, seals, walruses, rhinoceroses, elephants, antelopes, porpoises, kangaroos, alligators, and certain snakes and sharks. The process of tanning varies according to the materials employed, and the nature and thickness of the hides and skins. In this process tan made from oak or hemlock bark, or other woods containing the astringent substance called *tannin*, is used. The skins, after being cleaned of hair and flesh and otherwise prepared, are soaked in a solution of tan-bark and water, remaining until they are thoroughly impregnated with tannin. This has a preservative action and converts the hides into leather.

Dressed leather. After leather has been tanned, the currier and leather-dresser fit it for the many uses to which dressed leather is applied by a varied series of finishing operations. The surface of the leather is smoothed, and its thickness equalized. It is made soft, flexible, and water-proof; blackened, enamelled, or dyed.

Russia leather is tanned with birch-bark, which gives it a peculiar odor, and prevents moths and other insects from injuring books bound with it.

Morocco leather is so called because it was first brought from Morocco. It was originally made from goat-skins tanned with sumach, but now calf-skins and sheep-skins are used. Morocco leather is now made in France and in the United



LEECH.

States, and is largely used for covering chairs and sofas, for lining coaches, for book-binding, and for making pocket-books.

The finest gloves and ladies' shoes are made of kid leather. Sheep-skin is largely used for book-binding, hog-skin for covering saddles, horse-hide for harness, collars, etc., and cow-hide

for boots and shoes. A fine leather is made from seal-skin, and the skins of alligators are sometimes tanned for boots and shoes.

Leech. [AS. *læccan.*] A worm-like animal possessing one or two sucking discs. It is found in fresh and salt water, and sometimes on land. The medicinal leech is from 2 to 3 inches in length, with a minutely-ringed body, composed of 102 skin rings, and has a sucker moved by strong muscles. This species of leech is largely used in abstracting blood from the body for medical purposes.

Leek. [AS. *leac.*] The *Allium porrum*, a plant allied to the onion and used in soup.

Le'gion. The name given to a division of the Roman army, which corresponded to a brigade in modern armies. The legion—3,000 and afterwards 6,000 strong—was divided into centuries or companies of 100 men each. The word as now used indicates a great number.

Lem'ming. A small animal of the rat family, found in Scandinavia and Finland. It is a vegetable feeder, and is remarkable for its occasional migrations, in which bands of immense multitudes pass from the mountains to the sea. Great numbers are destroyed by carnivorous birds and animals and thousands are drowned, few living to return.

Lem'on. The name of a tree (*Citrus limonum*) and its fruit; a native of Southern Asia, but now cultivated in the south of Europe, especially in Sicily, in the West Indies, and in California and Florida. It forms a straggling bush, and is more delicate than the orange. There are many varieties of the lemon, but the most common are the common or Genoa lemon, the thin-skinned lemon, the sweet lemon, and the citron lemon. The chief products of the lemon are the juice and the oil. The juice has a peculiar and agreeable flavor, due to citric acid, and is much used in the well-known refreshing drink called lemonade. It is also very useful in the prevention and cure of scurvy. The rind of the lemon is used by cooks and confectioners for flavoring. The oil of lemons is extracted from the outside part of the peel either by pressure or by distillation, and is much used in medicine and in perfumery.

Le'mur. A family of arboreal animals bearing some resemblance to the monkeys in their mode of progression and their opposable thumbs and great toes. They are much less active and intelligent than the monkeys. They are chiefly natives of Madagascar.

Lens. [L. *lens*, a lentil seed, which is much like the shape of a convex lens.] A piece of glass or other transparent substance, which may be spherical on both sides, or one side may be spherical and the other a plane surface. There are many forms of lenses, their purpose being to refract the rays of light, causing them to converge to a point, to diverge, etc. Lenses are usually made of flat pieces of glass, and the greatest care is needed in grinding and polishing them, as the least unevenness in the surface would spoil them. They have many uses, but the most common is that of making eye-glasses

and spectacles—convex lenses being used for far-sighted and concave lenses for near-sighted persons. Lenses of various kinds are used in making opera-glasses, microscopes, stereoscopes, telescopes, and other instruments.

Lent'il. [Fr. *lentille.*] An annual plant not unlike the bean, a native of the countries bordering on the Mediterranean, and cultivated from the earliest times. It is now grown in many parts of Europe and Asia, the straw being used as fodder for sheep and cattle. The flour of lentils is made into lentil soup, which is considered highly nutritious.

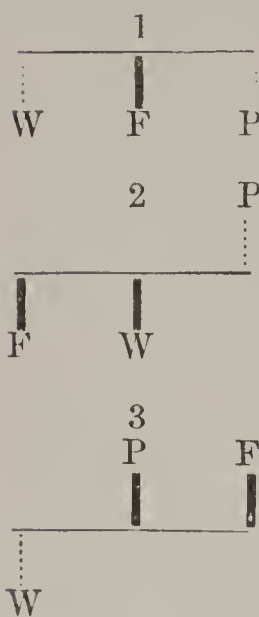
Leop'ard. [L. *leo*, and *pardus.*] A rapacious quadruped of the genus *Felis* or Cat group, found chiefly in Africa, though not uncommon in some parts of Asia. In general appearance it resembles the tiger, though not nearly so large. Its head, neck, back, and limbs are covered with black spots on a fur of a yellow color, whilst its sides are marked by at least ten ranges of black spots of a larger size. The leopard is very active, and can leap with the greatest ease, or ascend trees in pursuit of prey. It lives chiefly in thick forests, and its prey consists of deer, antelope, monkeys, and smaller animals, but it will sometimes visit farms and villages and feed on pigs, poultry, goats, sheep, or dogs. The leopard seems to dread and flee from man, and will only attack him when closely pursued or brought to bay. Leopards are captured by means of pit-falls covered with branches of trees, on which pieces of meat are placed as bait. They are chiefly valued for their skins.

Lep'rosy. A so far incurable skin disease, in which scaly patches, circular in form, appear on the skin and gradually spread. Its progress is very slow and those attacked by it may live for years. It is contagious and was very serious in ancient times and in the Middle Ages, the only treatment being to keep the lepers separate. It is now rarely seen in civilized countries. Of recent years it has been severe in the Hawaiian Islands, where the lepers are all sent to a settlement on the island of Molokai.

Let'tuce. [Fr. from L. *lactuca*, which is from *lac*, milk, the plant having a milky juice.] An annual plant, supposed to be a native of the East Indies; cultivated from remote antiquity, and now grown all over the world where the climate admits of it. The two principal kinds are the coss lettuce, with oblong upright leaves, and the cabbage lettuce, with rounded leaves and a head like a cabbage; and of these two kinds there are many varieties. The leaves of lettuce are used as a salad, and though they do not contain much nourishment, they are easily digested and gently laxative. Lettuce-opium is made from the juice of the plant, and is used medicinally to allay pain and induce sleep.

Lev'el. An instrument by which to find or draw a horizontal line in setting buildings. The *spirit-level* has a bubble of air on the surface of spirits of wine enclosed in a glass tube. In water-levels water is used instead of mercury or spirits of wine.

Le'ver. [Fr. *levier*.] One of the mechanical powers. It consists of a bar of wood or metal,



supported by and movable at some point of its length round a prop, called the *fulcrum*, while at the other points are placed the *weight* or resistance to be overcome and the *power* or force which overcomes it. Levers are divided into three kinds, namely—(1) when the fulcrum is between the weight and the power, as in the crowbar; (2) when the weight is between the power and the fulcrum, as in rowing a boat; (3) when the power is between the weight and the fulcrum, as in raising a ladder from the ground. Bones of animals are levers of the third kind.

Ley'den-jar. [Invented in Leyden, Holland.]

An instrument used to accumulate electricity. It is made of glass, covered on both sides with tin-foil nearly to the top, and for the purpose of charging it a brass knob is fixed to the neck of the jar, through which the electricity passes to the interior tin foil. (See *Electricity*.)

Li'chens. [Gk. *leichen*.] These are flowerless plants, without separate stems or leaves, found on rocks, trunks and branches of trees, walls and fences, and on barren soil. They are common everywhere and at all levels, many of them growing on mountain sides to the verge of perpetual snow. Lichens have no roots, but grow by receiving moisture through all parts of their surface. They contain a kind of starch, a bitter substance, a resin, and various coloring matters. They yield rich dyes of various colors, some of which are used in dyeing silks. Iceland moss is a lichen which grows in the most barren parts of Iceland and other cold countries, and is used for food and medicine. The reindeer lichen, covering the barren plains of Lapland and Siberia, is the chief food of the reindeers; and at one time, when grain was very scarce in Sweden, this lichen was ground up with flour to make bread. The *tripe de roche* is a lichen growing in the northernmost parts of North America, which the inhabitants there eat mixed with the roe of fishes. (See *Moss*.)

Life'boat. A boat constructed for saving persons in cases of shipwreck. Its chief qualities are strength, to resist the violence of waves, a rocky beach, or collision with the wreck; buoyancy, to avoid foundering when a sea is shipped; ability to right itself when capsized, facility in turning, and provision for speedy launching.

Light. [AS. *leoht*, *liht*.] The agent which produces vision and thereby enables us to see objects. Light comes to us from self-luminous bodies in the heavens—such as the sun, the fixed stars, nebulae, and some meteors; and from substances on the earth—such as the electric light, burning gas and oil, etc. Light proceeds from all luminous bodies in straight lines, each one of

which is called a ray of light. It is supposed to consist of undulations or waves in a rare substance called the luminiferous ether. It moves at the rate of over 186,000 miles per second, or more than a million times faster than sound, and it takes eight minutes for the light of the sun to reach the earth. When light falls upon the surface of a body, part of it is *reflected*, the rest enters the body. Thus, when we look at a house, the light goes first from the sun to the house, and then glances from it into our eyes, and thus we are able to see a thing which does not make any light itself. When a slanting ray of light passes from air into water, glass, or anything through which it can shine, the ray in the water, glass, etc., though still a straight line, is not a continuation of its old path, but is bent as it passes from one medium to the other. This bending of the ray is called *refraction*. (See *Prism*.)

Light'er. A large, open, flat-bottomed boat used in loading and unloading ships.

Light'house. A tower or building erected on headlands along the coast, and on rocks in the sea and in rivers, and at the entrance to harbors, from which a light is shown at night to guide mariners in navigating ships, and to warn them of hidden reefs or dangerous shores. *Lights* are fixed, revolving, flashing, colored, and intermittent. There are 530 lights round the British coasts, and they are so placed that at any point a ship is always in sight of a light. About 2,000 lights are on the United States coasts.

Light'ning. The vivid flash of light which accompanies a sudden discharge of atmospheric electricity. It occurs in three distinct forms—namely, forked lightning, sheet lightning, and ball-lightning. In forked lightning the path taken by the electricity is that which gives the least resistance, and is distinctly seen to be made up of straight lines and sudden bends. Sheet-lightning appears as a diffused glare of reddish color, spread over a considerable extent of the sky, and is sometimes called summer lightning, as it is of frequent occurrence in warm weather. Ball-lightning is a very destructive and dangerous form of lightning, but happily of rare occurrence.

Lig'num-vitæ. [L. *lignum*, wood; and *vitæ*, of life.] The name of the wood of the guaiacum tree, which grows in the West Indies and South America. The wood is very heavy, hard, close-grained, and tough, and is used for making pulleys, wheels in ships' blocks, pestles, rulers, and other articles which require to be of a tough material. The resinous juice of the tree is used in medicine in cases of rheumatism and skin diseases.

Lil'ac. [Sp. *lilac*.] A beautiful and fragrant flowering shrub, a native of Persia, brought to Vienna about three hundred years ago, and now cultivated as a familiar garden ornament throughout Europe and North America. The wood is fine-grained, and is used for turning, inlaying, and making small articles. A fragrant oil can be obtained from the leaves by distillation.

Lil'y. (*Lilium*.) The popular name of a family of plants of many species, producing flowers of great beauty and variety of colors. The root is a scaly bulb, the stem herbaceous and simple, sometimes several feet high, and bearing elegantly-formed flowers near the summit. The white lily is a native of the Levant, and is now extensively cultivated in gardens, its large white flowers being as much prized for their fragrance as for their beauty. The orange lily and the martagon or Turk's cap lily are natives of the south of Europe, and now form very showy ornaments of the flower-garden. The tiger lily is a native of China; and among the many species in North America the finest is the *superbum* (L.), which grows in marshes to the height of from 6 to 8 feet, bearing reflexed orange flowers spotted with black.

Lime. [AS. *lim*.] An alkaline earth, found as a carbonate in chalk, marble and limestone. Quick-lime is obtained by heating pure carbonate of lime to full redness in lime-kilns, when the carbonic acid is expelled and lime is left. When lime is moistened with water it swells up, gives off much heat and steam, and changes into a soft white powder, commonly called slaked lime (*calcium hydrate*). In this form it is used for purifying coal gas, in making mortar and plaster for building purposes, for removing the hair from skins in tanning, making paper pulp, and as a manure for land. When slaked lime is put in cold water and allowed to settle, the clear water is *lime-water*. In addition to the uses already mentioned, lime is used in the manufacture of washing-soda, bleaching-powder, and ammonia-water; in refining sugar, and also in iron-furnaces, lead-smelting, and glass-making. Bleaching-powder, commonly called chloride of lime, is a dry white powder, with a slight acid smell. It is largely used as a disinfectant. Carbonate of lime exists in great abundance in nature, and when crystallized is known as *Iceland spar*.

Lime-light. A light of great brilliancy, also called Drummond light, from its inventor. It consists of a burning jet of oxygen and hydrogen directed upon a cylinder of lime. This becomes white hot and yields an intense white light which has been seen at a distance of 112 miles. It is much used in the magic-lantern and the reflecting microscope.

Lim'pet. [*L. lepas*.] A small shell-fish which forms a *vacuum* under its shell, and adheres to rocks, being pressed by the weight of the atmosphere.

Lin'den or Lime. A large and beautiful tree, of which the American linden often grows to the height of 80 feet, and to 2 or 3 feet diameter. The leaves are large and serrated. The wood is white and soft, much used for carriage and cabinet work. The inner bark is strong, and ropes are made from it. In Europe the linden is also called the lime tree. The principal street of Berlin is named *Unter den Linden* (Under the Lindens).

Lin'en. [*L. linum*, flax.] A cloth very much used, made of flax, which is woven into such goods as tablecloths, cambric, lawn, shirting,

sheeting, towels, etc. Linen is manufactured in the British Islands, and in many manufacturing districts in Europe, particularly in France, Belgium, and Germany. Linen thread is prepared from fine bleached linen yarn.

Ling. A fish resembling the cod in form, but longer and more slender.

Lin'net. [Fr. *linot*.] A well-known song-bird, widely distributed in Europe and in the northwest of Africa. It is barely 6 inches in length, feeds on soft seeds, and forms its nest of soft stems and moss, lined with wool and down, in which it lays from four to six eggs of a bluish-white ground, speckled with reddish-brown, and generally rears two broods in a season.

Lino'leum. A kind of floor-cloth made of ground cork and oxidized linseed-oil spread on jute canvas, with oil-paint coated on the back. It was invented by Walton in 1860.

Lin'seed. [AS. *lin*, flax; and *sæd*, seed.] The seed of flax, largely used for making *linseed-oil* and *oil-cake*. In making oil the seeds are bruised or crushed, then ground and pressed in a hydraulic or screw-press, either cold or heated by steam. The seeds give more oil when heated, but the cold-pressed oil is the best. Linseed-oil is largely used in making paints, varnishes, and printing inks. The remains of the seeds after the oil is pressed out make oil-cake, which is valuable for feeding cattle. Linseed itself is excellent food for cattle and for poultry.

Lint. [AS. *linet*.] Linen cloth or rags scraped so as to form a soft material suitable for dressing wounds and sores.

Li'on. [Fr., from *L. leo*.] The largest representative of the *Felidæ* or Cat family. Its distinctive features are the large size of its head; the great mane, which covers the head, neck, and shoulders of the males; the uniform tawny color of the skin, without spots or stripes; and the tuft at the extremity of the tail. It attains its full growth when about seven or eight years old, and a male lion of the largest size will then measure about 8 feet, and the tail about 4 feet. The lioness is smaller, and has no mane. Lions are found in the tropical regions of Africa and Asia. Their lurking place is near a spring or by the side of a river, where, concealed among the brushwood, they wait for the animals coming to drink. They hide away in the daytime, and prowl about in the evening and early morning, and sometimes all night long, their eyes being better adapted for the night and twilight than for the day. They feed on antelopes, zebras, giraffes, and wild cattle, and sometimes carry off horses, sheep, and other domestic animals.

Liq'uid. [*L. liquidus*.] A fluid or flowing substance, distinguished from a solid by yielding laterally to pressure. It always returns to the same level.

Liquid Air. Air reduced by great pressure and intense cold to the liquid state. This process, of recent discovery, can now be performed with ease and rapidity, large quantities being produced at a low cost. Efforts are being made to use it as a

source of power. Air can also be frozen into the solid state, and every known gas, even the volatile hydrogen, can be liquified.

Liq'uorice. The word liquorice means "sweet root." The liquorice plant has stems 3 to 4 feet high, with small blue, violet, or white flowers, and the roots are sometimes half an inch thick and a yard long. It is cultivated in the south of Europe, chiefly in Spain and Italy. The roots are much used by porter-brewers. Spanish liquorice or liquorice juice is largely imported from the south of Europe in rolls or *sticks*, packed in bay leaves, or in the form of an extract run into boxes of about 2 cwt. each.

Lithog'raphy. [Gk. *lithos*, a stone; and *graphein*, to write.] The art of tracing letters, figures, and other designs on stone, and of transferring them to paper by impression. It was invented in 1796 by Alois Senefelder in Bavaria, where the most suitable stones are still quarried. The stone is a kind of limestone, composed of lime, clay, and silica, usually of a gray color and of a very fine grain. The stones are found in layers varying in thickness, the thickness required for printing-stones being from 1½ to 5 inches, according to size. They are ground face to face with sand and water, until the surface of both stones is perfectly level. After being carefully polished with a smooth polishing-stone they are ready for use. Writings or drawings may be made on the stone with a fine pen or brush, or drawn on paper having a specially prepared surface, and then transferred to the stone. The methods of printing, consisting of etching out the spaces between the lines of drawing with an acid, inking, etc., are too complicated to be here described. Chromo-lithographs are lithographs in which many colors are printed in one picture. As each color is printed from a separate stone, from three to thirty stones are often used to produce colored pictures.

Liv'er. [AS. *lifer*.] In man the largest gland in the body, situated in the right upper side and towards the front of the abdominal cavity, measuring about 12 inches from side to side, and weighing from 50 to 60 oz. The blood, laden with nutritious matter, has to pass through the liver before it can get into the general circulation; and the chief function of the liver is to secrete or gather the bile from the blood and send it into the gall-bladder, where it is stored up ready to be discharged into the intestines during digestion.

Liz'ard. [Fr., from L. *lacerta*, a lizard.] A term applied to an order of reptiles found in almost all countries, but most plentiful in warm climates. They include the gecko, monitor, dragon, frilled lizard, chameleon, and many others. The body is usually well covered with scales, and is supported usually on four legs. Lizards vary in length from a few inches to several feet. In a great many lizards the tail is almost as brittle as glass. A glove or handkerchief thrown upon one is enough to break it off, but a new one will soon grow out. Their food consists of insects, worms, and small animals; but some prey upon larger animals, and others are herbivorous.

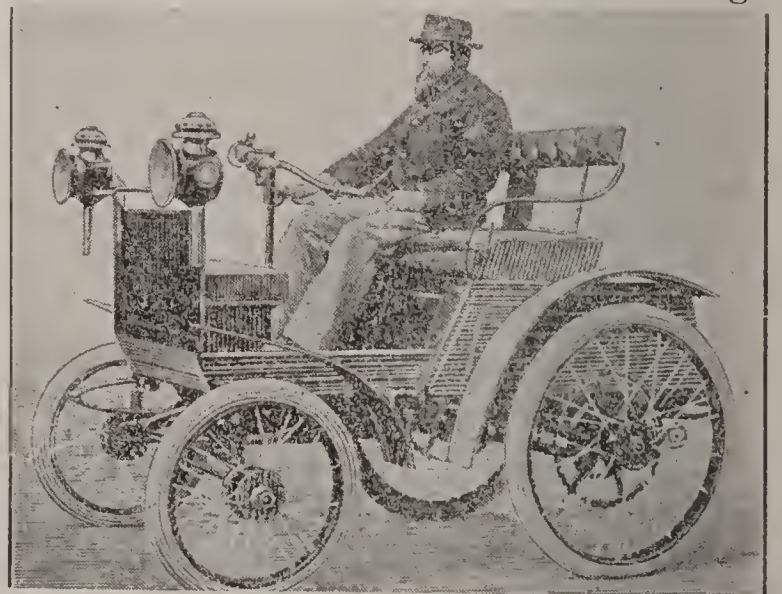
Lla'ma. A most useful South American animal, somewhat like a camel, but smaller and without a hump. The llama lives in flocks among the Andes, and feeds mostly on coarse grasses, mosses, lichens, and shrubs. The ancient Peruvians tamed the llama, and kept great numbers of them for beasts of burden; and it is still put to this use in many parts of South America, especially for carrying goods across steep mountain roads where horses cannot go. The hair of the llama is woven into stuffs similar to alpaca.

Load'stone or Magnetic Iron Ore. A hard reddish-black or grey mineral, found in various countries. (See *Magnet*.)

Lob'ster. A well-known crustacean, much esteemed for food. Lobsters are found all round the coasts of Europe, and along the Atlantic coast of the United States north of New York. Immense quantities are sent from America to Europe, packed and preserved in hermetically sealed cans. Lobsters differ in size, weighing from 2 to 15 lbs. Their two large claws are fitted with tooth-like serrations—in the one they are many and sharp, in the other few and blunt—and with these they crush their food, which is chiefly clams, mussels, and other molluscs. They are caught in traps made either of basket-work or of netting, the bait used being dead fish. The shell of the lobster is dark-green when alive, but it turns to bright red when boiled.

Lock. [AS. *loc* or *loce*.] A well-known instrument for fastening doors, drawers, chests, etc., generally opened by a key. The chief parts of a lock are the bolt or part which locks, and the staple into which the bolt enters when turned by the key. Good locks are distinguished by the number of impediments that can be interposed betwixt the key and the bolt, these impediments being called the *wards* of the lock, which are so arranged as to slip into corresponding grooves of the key. The *tumbler-lock* has two notches on the upper side of the bolt, on which rests the tumbler, which is pressed by a spring into the notches according as the lock is open or shut.

Locomo'tive Steam-engine. The traction engine

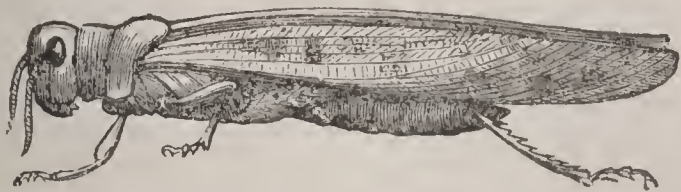


used on railroads for drawing cars. The first effective locomotive, the "Rocket," was invented by George Stephenson in 1829, though others

had been made earlier. Since then immense improvements have been made and very swift and powerful locomotives built.

Locomobile'. An automobile or motor carriage moved by steam.

Lo'cust. [*L. locusta*.] An insect somewhat like a grasshopper in shape, but with shorter antennæ or feelers and stouter legs. Its hind legs are very strong, enabling it to make long leaps; and its wings are beautifully colored, and from their great length give it the power of sustaining long and high occasional flights. "Locusts fly in great clouds from place to place, and eat up every



green thing where they alight." In some parts of Asia and Africa they come in such numbers as to darken the sky in their flight, and they are frequently seen in southern Europe and commit great ravages there. They have also been very destructive in the western United States, where they are known as the Rocky Mountain locusts. The *seventeen-year locusts* live as larvæ in the ground for seventeen years, and afterwards come to the surface and become winged insects. Some species remain underground for a shorter period.

Locust or St. John's Bread. A tree highly valued for its wood. Its leaves are soft and velvety, and it bears clusters of white, sweet-smelling flowers. Its wood is compact and hard, of a greenish-yellow color. The honey-locust tree of America and the West Indies is a large tree, but its wood is not so valuable as that of the common locust. It bears long flat pods full of brown seeds, in a honey-like pulp. Its trunk and limbs are covered with sharp thorns.

Log. A part of the apparatus for measuring the rate of a ship's motion through the water, consisting of a flat piece of wood, usually in the form of a quadrant, loaded with lead at its circular edge to make it float upright. To it is attached the log-line, which runs freely from a reel, and is marked by *knots* at intervals of five fathoms. The number of *knots* run out during the running of the half-minute sand-glass tells the number of miles per hour which the vessel is making. (See *Knot*.)

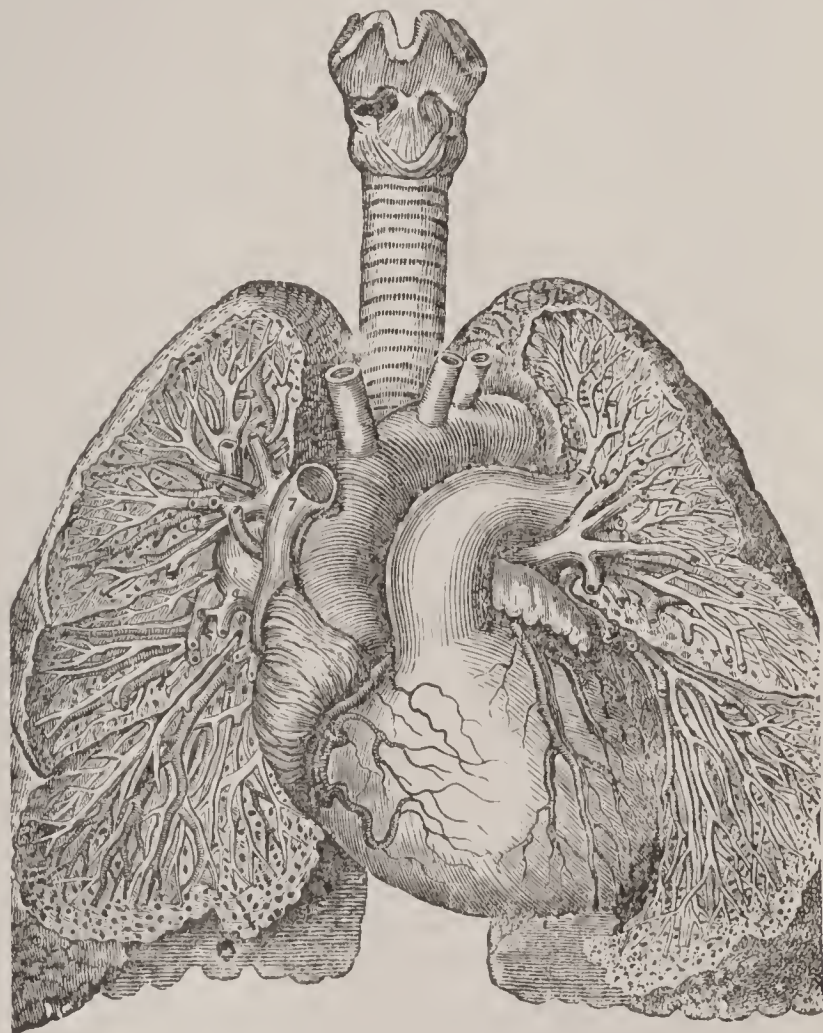
Log'wood. [So called because it was brought to Europe in logs.] A tree which grows in Central America, on the Bay of Campeachy, and some of the West India islands. The wood, sometimes called *Campeachy wood*, is of a deep red color internally, and is very extensively used as a dye-wood. Logwood is sometimes used as a medicine.

Lon'gitude. The lines of longitude are a series of imaginary lines which surround the earth at right angles to the equator and pass through the poles. Longitude is measured along the equator east or west from a standard line or meridian, that of Greenwich, England, being usually employed. The length of a degree of

longitude decreases north and south from the equator, and vanishes at the poles, where the lines all meet.

Lum'bering. The cutting of forest timber for commercial use. This has become an immense industry in the United States, more than 24,000,000,000 feet being cut annually for various purposes. The white pine has long been the favorite lumber tree, but many others are used.

Lungs. [*AS. lungen*.] The lungs are the organs of respiration. In man the lungs lie in the thorax or chest on each side of the heart—the right lung being a little shorter and broader than the left lung. They are light, spongy bodies, full of little cells which can be filled with air. The blood sent from the right side of the heart to the lungs is of a dark color, and contains much carbonic acid gas; while the blood taken away from the lungs back to the left side of the heart is of a scarlet hue, and contains less carbonic acid gas and more oxygen. The oxygen



THE LUNGS, WIND PIPE AND HEART

is taken from the air that enters the lungs, while a nearly equal quantity of carbonic acid gas passes from the blood outwards into the air, and is expelled from the mouth. (See *Heart*.)

Lute. An ancient musical instrument, of the guitar kind. It somewhat resembles the pear in shape, and was played by striking the strings with the fingers. It was in common use till the end of the 17th century, when the guitar took its place.

Lynx. [*L. lynx*.] An animal resembling the common cat, but with longer ears and a shorter tail. It preys on small quadrupeds and birds, and in pursuit of prey frequently climbs to

the tops of tall trees. Lynxes are widely distributed throughout Europe, Asia, and North America. The Canada lynx is hunted for its fur, which is prized for robes, muffs, and collars.

Lyre. The oldest known of all stringed instruments, invented, according to old tradition, by

the god Mercury. It was the predecessor of the harp, and possessed at first but three strings, which were gradually increased to eleven. It was played upon by a stick of ivory or polished wood. It was used to accompany the voice and was probably of Egyptian origin.

M

Macad'am. Broken stones, about from 2 oz. to 6 oz. in weight each, used as road metal; invented about 1810 by Macadam, a Scottish road contractor.

Macaro'ni. [Ital. *maccheroni*, from *maccare*, to bruise or crush.] A kind of food made from the paste or dough of fine wheat flour, formed in small tubes or pipes. It forms a favorite article of food among Italians. In the neighborhood of Naples whole villages are engaged in its manufacture. It is also made at Marseilles and other places in the south of France, and large quantities are exported to all parts of the world. Macaroni is used in various ways—boiled, served with grated cheese, for thickening soups and for making puddings.

Macaroon'. A favorite cake or biscuit, composed chiefly of the meal of sweet almonds, whites of eggs, and sugar.

Macaw'. A race of beautiful birds found in the tropical regions of America, and included in the Parrot family.

Mace. A staff with an ornamental head, carried before officers of state and magistrates as an emblem of authority; a well-known spice, which forms the inner envelope of the growing nutmeg. It occurs as a fine scarlet net-work, which is stripped off and dried. It is regarded as the most choice of all the spices.

Mack'ereL. [Fr., from L. *macula*, a spot.] A well-known salt-water fish, marked with spots on its sides, and much used for food. They move about in vast shoals, and visit the British and American coasts in summer, following after herrings, sprats, or pilchards, on which they prey. They are caught by means of drift nets and shore weirs, but a common mode of capture is by hook and line. The hooks are baited with small pieces of mackerel skin; but the mackerel is a very voracious fish, and will bite at a piece of red flannel, or anything brightly colored or of a glittering appearance. The common mackerel averages 14 inches in length, and weighs about 2 lbs.

Mad'der. [AS. *mæddere*.] The name of a very useful red dye obtained from the roots of the madder plant, which is found in the warm parts of the Old and New Worlds. Madder is used by dyers to make a great variety of red tints, and by varying the mordant such colors as madder-orange, madder-purple, madder-yellow, etc., are easily produced. Turkey-red used in dyeing cotton goods is a madder color. Alizarin, the red coloring principle of madder, is now made artificially.

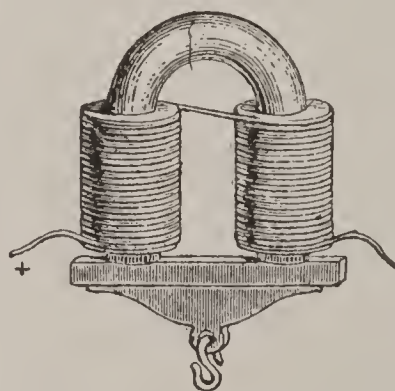
Mag'ic=Lan'tern. An optical instrument which, by means of lenses and a lamp or lime-light, enlarges small figures painted with transparent

varnish on sides of glass, and exhibits them on a white screen in a darkened room. It is said to have been invented by Athanasius Kircher in 1646. At present transparent photograph slides, plain or colored, are used in the lantern, and much used in illustrating lectures.

Magne'sium. A metal of a silver-white color, found in many minerals. It is got by fusion from magnesium chloride. It is very light, easily tarnished, and when lighted burns with a brilliant glow. It may be drawn into wire, filed, bored, or flattened easily. On burning, magnesium unites with oxygen, and leaves a white powder. This is called magnesia (*magnesium oxide*), which, when united with sulphuric acid, makes magnesium sulphate. Magnesium sulphate is found in a mineral spring at Epsom in England, and is commonly known as Epsom salts.

Mag'net. [L. *magnes*, from *Magnesia*.] An ore of iron, "the loadstone," first found at Magnesia, a city in Lydia; now found in different parts of the world, especially in Sweden and in the

States of New York and New Jersey. A load-stone or natural magnet has the peculiar properties of attracting iron and some of its ores, and of pointing to the poles. If a load-stone be held near to iron filings, they will cling to it in a cluster. Tacks and small nails may be raised by it, and if the load-



stone be a large one it will hold up quite a heavy weight. This power which the load-stone has of attracting iron is called magnetism. Bars of iron or steel may have the properties of the loadstone or natural magnet imparted to them, and hence we have what are called *artificial magnets*. Common iron will not keep its magnetic properties long, but steel will. Artificial magnets are made of various forms, the most common being the bar shape. Powerful permanent magnets are made by placing several thin magnetized bars side by side, fastened firmly together. Such a collection of magnets is called a *magnetic battery*, and is more powerful than a solid bar of the same weight. A bar of soft iron may have the properties of a magnet imparted to it by sending a current of electricity through a coil of wire surrounding it. It is then called an *electro-magnet* (See *Dynamo*.)

Magno'lia. [*Magnol*, a professor of botany at Montpellier, died 1715.] The name of a tree, a native of North America, India, China, and

Japan, now very widely cultivated, and much admired on account of the beauty of its flowers and foliage.

Mag'pie. [*Mag*, short form of Margaret; and *pie*, from *L. pica*, a magpie.] A bird of the Crow tribe, distinguished from the true crows by its small size, short wings, long tail, and variegated plumage. It is noted for its cunning, is easily tamed, and may be taught to speak a few words. It feeds on snails, slugs, worms, frogs, rats, mice, and the eggs and young of poultry; and when disturbed by any person or animal it keeps up a continual chatter, from which comes the saying to "chatter like a magpie." Magpies are common in Europe and in the northern parts of America.

Mahog'any. The wood of a tree of the same name, a native of Central America and the West Indies. It is a beautiful tree, from 80 to 100 feet high, the trunk being often 5 feet in circumference. The wood is heavy, hard, close-grained, of a reddish-brown color, and susceptible of a brilliant polish. It is used in the making of furniture, and for the inside woodwork of railway cars, sometime solid, but more often as a veneer, or thin layer glued on inferior wood. The wood varies much in value according to the color and beauty of its veins.

Maid'enhair. A species of fern, so called because of its very fine hair-like fronds.

Maize or Indian Corn. An important grain of American origin, distinguished by the peculiar arrangement of its large seeds on a long cylindrical cob. It grows on a stalk resembling that of the sugar cane, varying from 5 to 10 feet in height. Its cultivation is simple, and the returns very large, its produce being greater than that of any other grain. Corn-flour is extensively used as food. Maize meal is not well adapted for making bread, but is sometimes mixed with wheaten flour for that purpose. It is also used in the manufacture of starch. In some countries

the husks are used in making paper and mattresses, and in stuffing chairs and saddles. More than 2,000 million bushels of maize are grown in the United States annually, much of it being used in fattening swine.

Mal'achite. A mineral of a dark and emerald-green color; a carbonate of copper, much used for ornamental purposes.

Mala'ria. [*Ital. mala*, bad; and *aria*, air.] A

poisonous condition of the air most powerful near marshes, producing certain kinds of low fever. It is found to be due to a bacterial microbe, probably largely disseminated by mosquitoes.

Mal'let. [*Fr. maillet*.] A wooden hammer for beating lead, etc., for driving wooden pins, or for using with chisels.

Mal'low. A plant common throughout Europe and in Britain, on waysides and heaps of rubbish. Its soft downy leaves are sometimes used to allay external inflammation.

Malm'sey. [From *Malvasia*, in the south of Greece.] The name of a sweet wine, or the grape from which it is made; originally exported from Malvasia, but now made in other places.

Malt. [*AS. mealt*.] Barley or other grain steeped in water until it begins to germinate, and then dried to stop the growth, thus converting the starch of the grain into sugar. It is used in brewing and distilling.

Mam'mals. [*L. mamma*.] The highest class of vertebrate or backboned animals; so called because they all feed their young with milk formed in their own bodies. In mammals the heart is divided into four chambers, the blood is warm, and the skin has a covering of hair, wool, or bristles.

Man. [*AS. man*.] Man is the chief of mammals, the superior of all animals, the only one which walks erect, and the only one which talks. He excels all other animals not only in body, but in mind. This enables him to reason and to invent, and to have power over the elements and lower animals. The mind is seated in the brain, and man has a much larger brain, in proportion to the size of his body, than any other animal. The human body is made up of the head, trunk, arms and legs. The head contains the brain and the organs of hearing, seeing, smelling and tasting. The trunk is divided into two parts by a partition called the diaphragm. The upper part, called the thorax or chest, contains the heart and lungs; and the lower part, larger than the upper, called the abdomen or belly, contains the stomach, intestines or bowels, liver, and kidneys. The arms and legs are made up of a framework of bones joined together by ligaments.

Man'akin. The name applied to a race of birds common in the tropical parts of South America, of very small size, and noted for the beauty of their plumage.

Manchineel'. [*L. mancanilla*.] A tree which grows in the West Indies and tropical America, noted for its poisonous fruit and poisonous milky juice. The Indians use it for poisoning their arrows. The wood is of fine quality, beautifully veined, and highly valued for cabinet-work.

Man'atee. A genus of marine, plant-eating mammals, known as cow-whales or sea-cows, found in the coast waters and river mouths of Africa and South America. They include the Manatee and the Dugong.

Manganese'. A metal closely allied to iron. The important manganese ores are black oxide, brown oxide, and bog manganese. Large deposits exist in Spain, Portugal, and the United States. In Nova Scotia there is an ore very free from iron much used in glass-making. Manganese is largely used in the Bessemer process and as spiegel iron.

Man'go. [*Malay*.] The fruit of the mango-tree, which grows in India and the East and West



WINE SKIN BOTTLES.

Indies. It is very nutritious, and is used as a dessert in hot countries. The green fruit is pickled in the East Indies.

Man'gold or **Man'gel-wurzel**. [Ger. *mangold*, beet; and *wurzel*, root.] A plant resembling beet, but larger and coarser, extensively cultivated as food for cattle.

Man'grove. [Malay.] This tree grows on muddy shores and river-banks in tropical countries. It sends down shoots from its branches, which take root and form new stems.

Manil'a-hemp. [From *Manila*, in the Philippine Islands.] The material obtained from the thread-like fibres of a kind of banana-tree which grows in the Philippine Islands, and largely used for making cables, ropes, and cordage.

Manioc or **Mandioc**. (See *Tapioca*.)

Map. [Fr., from L. *mapa*, a napkin.] A drawing or representation on paper or other material of the surface of the earth or part of it, showing the shape and position of the countries, seas, rivers, etc.

Ma'ple. [AS.] A tree with a great variety of species, many of them found in North America, some in Europe and Asia, and a few in Japan. Some are small shrubs and others are large trees. The red maple, the sugar maple, and the white maple are common throughout the United States. The wood of the red maple is used for inlaying and for making stocks of rifles and fowling-pieces. The sugar maple yields a sap from which sugar is made, and the wood forms excellent fuel, and makes the best of charcoal. Some kinds, called curled and bird's-eye maple, because the grain is twisted or marked like birds' eyes, are used in cabinet-work. The wood of the common maple, a native of many parts of Europe and Asia, is fine-grained, compact, takes a high polish, and is much used by turners, and for carved work.

Mar'ble. [Fr., from L. *marmor*.] Certain varieties of limestone, of sufficiently compact texture to admit of a polish, are known by the name of marble. It is a beautiful stone, usually white, but frequently colored, and marked with stripes, spots, and shades of different tints. As a building stone, marble is valuable for its great durability; and being susceptible of a brilliant polish, is largely used for the purposes of art or architectural ornament. Carrara marble, from quarries in North Italy, and Parian marble, from the isle of Paros, are famous for statuary purposes.

Mar'garin. [Fr.] A solid, fatty, pearl-like substance (of stearin and palmitin) made from olive and other vegetable oils, and also from the fat of some animals.

Mar'igold. A well-known annual plant, bearing a large yellow flower, a native of France and the southern parts of Europe. The French marigold and the African marigold, both Mexican species, have brilliant flowers, and form beautiful borders in flower-gardens. The well-known ice-plants are fig-marigolds.

Mar'joram. [Fr.] A genus of plants of the natural order Labiatae. The most common kind is the sweet marjoram, which diffuses a sweet

and pleasant odor, and is much used in cookery for seasoning.

Marl. A mixture of clay and carbonate of lime, found in Europe, and along the Atlantic coast from New Jersey southward. It is used as a fertilizer.

Mar'malade. [Portuguese *marmelada*; from *marmelo*, a quince.] A preserve made by boiling fruits, such as oranges, pine-apples, and quinces. The most common kind of marmalade is made from bitter or Seville oranges. The rind is cut up into thin strips and boiled with the pulp and an equal weight of sugar, to which half that weight of water is added.

Mar'moset. A small kind of monkey, found only in South America.

Mar'mot. An animal nearly allied to the squirrels, but in form and habits more closely resembling rats and mice. Marmots are natives of the higher parts of the Alps and Pyrenees, and of Central Asia and North America.

Mar'row. [AS.] Fatty matter contained in the hollow parts of the large bones of animals. The whale, the skate, and the turtle have no cavities in their bones.

Mars. The smallest of the planets except Mercury, and the nearest to the earth of the outer planets. It is of nearly 5,000 miles diameter, and about 142,000,000 miles from the sun. It is the only planet the details of whose surface can be seen from the earth, and presents interesting appearances not yet understood.

Marsu'pials. An order of mammals distinguished by the fact that the young are born in the embryo state, and are carried for a time in a peculiar pouch in the abdomen of the mother.

Mar'ten. [Fr. *marte*.] A genus of carnivorous quadrupeds, belonging to the Weasel family. The body is elongated and slim, the ears larger than in the weasel, the tail bushy, the legs short, and the feet have five toes, with long sharp claws. Martens live generally in thick woods, and can climb trees with the greatest ease. They feed on rats, mice, birds, and other small animals. They are widely distributed over Europe, Asia, and North America. The sable marten inhabits Siberia, and furnishes the highly valuable sable fur. The pine marten, or American sable, is found in the northern parts of North America, especially in the thick pine woods. It is much hunted for its fur, which is very handsome and highly prized.

Mar'tin. A genus of birds of the Swallow family. The best known of the American species is the purple martin. It will readily nest in a bird-box, near houses.

Mas'sage. A system of medical treatment by kneading, rubbing, and stroking the muscles, used especially for nervous diseases.

Mas'tiff. A large dog, noted for its strength and courage, often used for watching houses.

Mas'todon. A kind of large animal allied to the elephant, but larger and with tusks of great length. It was formerly abundant in the United States, and probably lived in the early human period, but is now only found as a fossil.

Match. A small splint of wood, tipped with some very inflammable composition, which bursts into flame upon friction. The first used were brimstone matches, tipped with sulphur. In 1829 an English chemist discovered friction matches, and the making of matches is now an important industry. The best wood for matches is white or yellow pine. The wood is cut into blocks, and the blocks into square splints. The splints are dipped into melted sulphur, and afterwards into phosphorus, mixed with nitre, fine glue, etc. *Safety matches* can be kindled only by rubbing upon the side of the box, on which the phosphorous composition is glued.

Mat'tock. [AS: *mattuc*, a shovel.] A tool of husbandry, used for digging and grubbing up roots of trees and weeds.

Mat'tress. [O.F. *materas*.] A quilted bed, stuffed with hair, wool, or other soft material, instead of feathers.

Ma'vis. [Fr. *mauvis*.] A thrush; properly the song-thrush, not the screech-thrush.



Medal. A circular piece of metal stamped or engraved with a head or design upon it and issued usually to celebrate or mark some great event.

Meer'schaum. [Ger. *meer*, the sea; and *schaum*, foam.] A light, soft magnesian mineral, used in Turkey and Germany in the manufacture of tobacco-pipes.

Mel'on. [Fr., from L. *melo*.] A plant of the Gourd family, to which the cucumber also belongs. It is an annual, with trailing stems, angular leaves, yellow flowers, and bearing a large juicy fruit, which possesses a delicious flavor. It is largely cultivated. The native country of the melon is unknown, but there are numerous varieties found throughout Europe, Asia, and America. The two principal kinds of melons in the United States are the musk-melon and the water-melon (*citrullus*).

Mem'brane. [Fr. *membrane*.] A thin organ, resembling a supple elastic web, serving to secrete a fluid, or to separate, envelop, and form other organs.

Mer'cury. [L. *mercurius*.] A metal of a silvery-white color, also known by the name of quick-silver. It is a liquid at ordinary temperatures, becomes solid at 39° below zero F. and boils at

662° F. Small drops of the pure metal are sometimes found, but its common ore is cinnabar (mercury sulphide), composed of mercury and sulphur. Mercury unites with most metals to form alloys called amalgams. These are very extensively used in the processes of silvering and gilding, in the production of vermilion, and in extracting gold and silver from their ores. Mercury is used in making barometers and thermometers, and in various medicines. Cinnabar, the ore from which mercury is chiefly obtained, is found in Almaden (Spain), Illyria, and the Ural Mountains, and in California, Peru, China, and Japan.

Mer'cury. The smallest planet, and the one nearest to the sun; its distance being 36,000,000 miles. It is 2,992 miles in diameter, and moves around the sun at the speed of 105,000 miles an hour, its year being equal to 88 of our days. Its period of rotation on its axis is not known.

Merid'ian. [L. *meridies*, mid-day.] A great circle thought of as passing through the North and South Poles, and also through any place on the earth's surface. Thus every place has its own meridian, and it is mid-day at any place on the earth's surface when the centre of the sun comes upon the meridian of that place.

Meri'no. [Span.] A breed of sheep with fine wool; originally in Spain, now largely raised in the United States and Australia; also the name of a cloth made from this wool.

Merry=thought. A forked bone between the neck and breast of a fowl; so called from being that which two persons pull at in play. The one who breaks off the longer part has the omen of being first married. Also called wish-bone.

Met'als. [L. *metallum*.] Minerals having certain properties, the chief of which are—1. They are all opaque, and they all have a shiny surface known as the *metallic lustre*. 2. They are good conductors of heat and electricity. 3. With the exception of gold and copper, their color is a grayish white. 4. With the exception of mercury, they are all solids at ordinary temperatures. 5. All metals can be melted, but the temperatures at which they assume the fluid form vary very much. 6. Great weight, most metals being heavier than water. Platinum is more than twenty times as heavy as water. Metals differ from each other in malleability, ductility, and tenacity. A metal is said to be malleable when it can be hammered out into thin sheets. Gold is the most malleable, and next to it in order are silver, copper, platinum, iron, tin, zinc, and lead. Some metals are so brittle that they cannot be hammered at all. When a metal can be drawn out like wire, it is ductile. Gold is the most

ductile of all metals. When a metal has the power of holding together under a strain, it is said to have tenacity. Iron is the most tenacious or elastic of all metals.

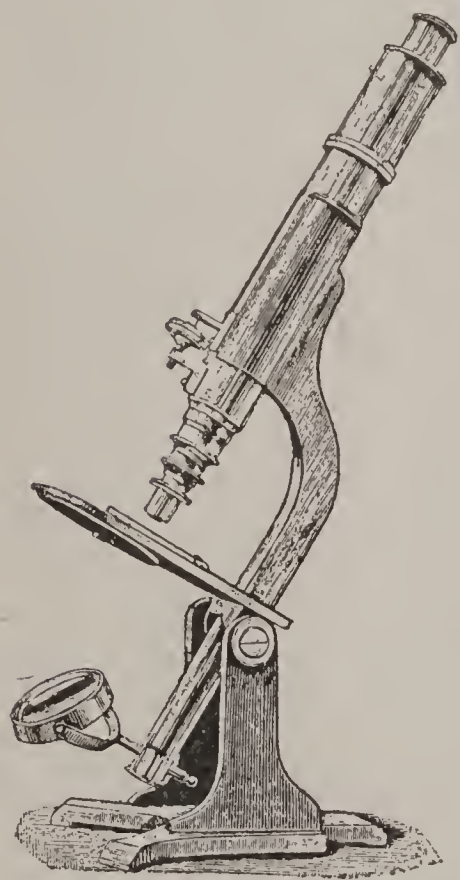
Me'teor. [Fr. *meteore*.] Any natural phenomenon in the atmosphere or clouds; applied particularly to a fiery or luminous body occasionally seen moving rapidly through the atmosphere, and to a fireball; called also a *falling star*. (*q.v.*)

Me'tre. [Fr. *metre*.] Unit of the metric system of length, equal to 39.37 English inches.

Mi'ca. [L. *mica*, a small bit.] A mineral found in granite and most of the other primary rocks. It easily divides into glittering plates of great thinness. It is so transparent that it is used in Siberia, China, Peru, and other countries as a substitute for glass in windows. Mica is sometimes preferred to glass for lanterns, and is also used for doors of stoves, as it is not so liable to break with sudden changes of temperature.

Mi'crophone. An apparatus for magnifying very faint sounds, by variation of electrical resistance. It forms the basic principle of the carbon telephone transmitter.

Mi'croscope. [Gk. *mikros*, small; and *skopein*, to see.] An instrument for viewing objects which are too small to be seen with the naked eye.



A simple microscope consists of a tube having one convex lens, which magnifies the object; while a compound microscope has two convex lenses in a tube, one of which is called the object glass, and the other one the eye-glass. In the compound microscope the thing looked at is first magnified by the object-glass, and this is again magnified by the eye-glass. The microscope is an interesting and wonderful instrument, and by its means many living things invisible to the naked eye are revealed. The microscope is also ap-

plied to the study of rock structure by grinding down the stone to thin sections. Preparations for the microscope are preserved on glass slips (3x1 in.) covered by very thin glass fastened by Canada balsam or shellac.

Mignonnette'. [Fr. *mignonnette*.] An annual plant and flower prized for its delicate and agreeable fragrance.

Milk. [AS.] A white fluid secreted in the mammary glands of the females of all mammals. When examined under the microscope, milk is seen to consist of a clear fluid, filled with round floating balls of fat of very minute size, each one

enclosed in a separate film or thin skin of albumen. When milk has stood for some time these balls of fat rise to the surface, and form a layer of cream. When cream is churned the cases of the balls are broken, and the fat runs together and makes butter. Skimmed milk is that which remains after the cream is removed. Condensed milk is prepared from that of the cow, sweetened with sugar and boiled down until the water is out of it, thus forming a thick, sweet paste, which is sealed up in tin cans.

Mil'let. [Fr., from L. *milium*.] The name of several kinds of grasses bearing a great number of small round seeds used as food. The common millet is a native of the East Indies, but is also cultivated in the warmer parts of Europe, Africa, the United States, and the West Indies. The seeds are ground up into meal for bread. Certain kinds of millet bear seeds used as food for cattle, poultry, and cage-birds.

Milk'weed. A family of plants found in North and South America, which are full of milky juice. The seeds are covered with a silky down, which has been mixed with cotton and woven into cloth. The root is used in medicine.

Milky Way. A broad, luminous belt encircling the sky, and shown by the telescope to be made up of a countless multitude of suns, so immensely distant as to be very dimly visible. There are probably more than a thousand millions of suns in this wonderful belt.

Mimo'sa. [Gk. *mimos*, imitator.] A genus of leguminous plants, including among its species the sensitive plant, so called from its seeming to imitate the sensibility of animal life.

Mine. [Fr. *mine*.] A subterranean work or excavation for obtaining metals, metallic ores, or other mineral substances. The deepest mine is the Spensenberg, near Berlin, 4,175 feet.

Min'eral. [It. *minerale*.] A natural body destitute of organization or life; a substance found in or on the earth which is neither animal nor vegetable.

Mineral Waters. Waters or springs impregnated with mineral substances.

Mink. A quadruped of the Weasel tribe, often called minx, and valued for its fur, which is of a chestnut-brown color. It is found in the cold parts of North America, Europe and Asia, living on the banks of rivers and lakes, and feeding on small birds, fishes, frogs, and mussels.

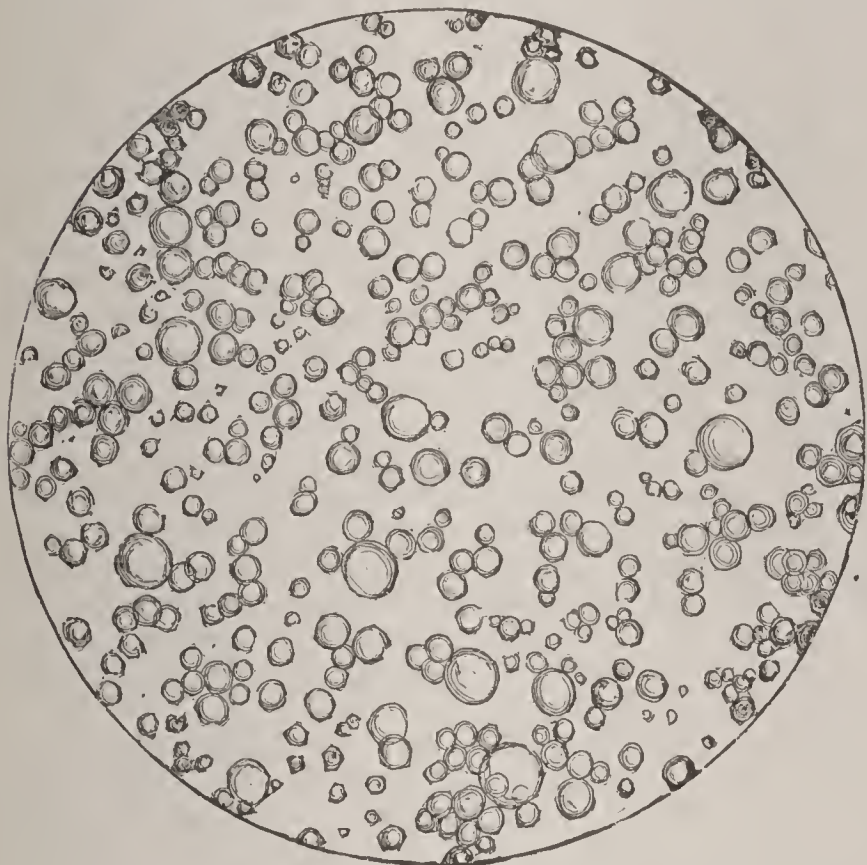
Min'now. [Fr. *menu*, small.] The name applied to several species of very small fishes found in fresh-water ponds and rivers. Minnows average from 2 to 3 inches in length, and feed on aquatic plants, worms, insects, and small snails. They are generally caught by a small hand-net, and used as bait to catch other fish.

Mint. [AS., from L. *mentha*.] The name of a strongly-smelling plant, with flowers in whorls. Numerous species are known, widely distributed over the world, but the most important are spearmint and peppermint. Spearmint is the common mint found in gardens, and is largely used in making mint-sauce and for flavoring soups. The oil of mint is distilled from the leaves, and from

the oil are made the essence of mint and mint-water. Peppermint is cultivated chiefly for the oil which it yields, so much used for flavoring confectionery and for making cordials and essences. Essence of peppermint is made by mixing the oil with alcohol, and is used in medicine.

Mi'rage. An optical illusion often seen in hot climates, especially in deserts. Travelers apparently see a broad lake with surrounding trees, where only desert sand exists. It is a phenomenon of refraction.

Mir'ror. [Fr. *miroir*.] A plate of glass lined at the back with a brilliant metal, so as to reflect the image of any object placed before it. Mirrors are made by coating the back of a sheet of plate-glass with an amalgam of mercury and tin-foil. In ancient times mirrors were made of polished metal. Ordinary mirrors have flat surfaces, but there are also *convex mirrors*, which cause the rays of light to diverge and decrease the size of the reflected image, and *concave mirrors*, in which the rays are reflected to a focus and the image magnified. Beyond the focus it is inverted.



MILK UNDER THE MICROSCOPE

Mist. [AS.] Moisture visible in the air; rain in very fine and almost imperceptible drops. (See *Fog*.)

Mis'tletoe. [AS. *mistel*.] An evergreen plant that grows on the branches of many kinds of trees. In winter it is covered with small white berries. This plant was held in great veneration by the Druids and is now used in the Christmas festivities.

Mi'tre. [Fr., from Gk. *mitra*.] A crown or head-dress worn by archbishops and bishops during solemn church services.

Mitre-joint. The joint made by the ends of two pieces of wood fitted together at a right angle, as in the corners of a picture-frame. The mouldings are usually sawn in a *mitre-box*, the sides of

which have saw-cuts through them at an angle of 45° to guide the saw in cutting.

Moc'casin. A venomous snake of the United States, resembling the rattlesnake, but without a rattle. The name is sometimes given improperly to the copperhead. Also the shoe of buck skin formerly worn by the Indians.

Mock'ing-bird. A bird which gets its name from its habit of imitating the songs of other birds. It is a kind of thrush, found only in North and South America and the West Indies. Its form is graceful, but its plumage is not very handsome. Its own song, which is sweet and pleasing, is heard mostly at night. During the day it imitates the songs of other birds, passing from one to another with the greatest ease, now warbling like a canary or blue-bird, then cackling like a hen or screaming like a swallow. It can imitate various other sounds, and readily learns to whistle a tune. Mocking-birds feed chiefly on berries and insects, are easily tamed, and live happily in cages if caught when young.

Mo'hair. [Fr. *moire*.] The hair of a kind of goat found in the neighborhood of Angora, in Asia Minor, and now also at the Cape and in California. The covering of this goat is a long, soft, silky, pure white hair or wool, which is woven into varieties of camlet, shawls, and trimmings, and in France into a fine kind of lace.

Molas'ses. [L. *mellaceus*, honey-sweet.] The thick liquid of the juice of the sugar-cane, which separates from it in the process of manufacture. (See *Cane Sugar*.)

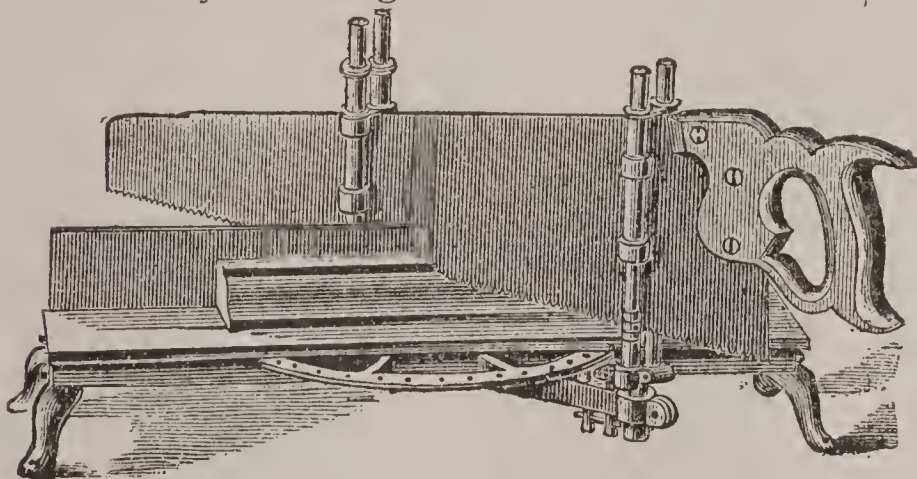
Mole. [O.E. *mold* *warþ* = thrower-up of mould or earth.] The mole is found in Europe, Asia, Africa, and North America; but is not found in Ireland or in the Western Isles of Scotland. From its habits and mode of life it is one of the most interesting of mammals. It lives underground, and seldom sees the light. Its food consists of earthworms and the larvæ of insects. It has a long cylindrical body, very short limbs, and a pointed snout. Its forearms, hands, and claws are shaped into strong tools for scraping, digging, and shoveling away the earth. The eyes are completely hidden in the fur, and though the sense of sight is probably very imperfect, the senses of hearing and smelling are very acute. Moles in making their tunnels damage the roots of plants, but they are very useful in destroying a vast number of grubs, which would otherwise feed on and do more damage to the roots than the moles.

Mollus'ca. [L. *mollis*, soft.] The animals included in this group have soft, inarticulated bodies, usually inclosed in a shell, the body covered with a sensitive contractile skin, kept moistened by a viscid fluid which exudes from it. In one large division of molluscs (gastropods) the under surface of the body is covered by a broad fleshy disc or foot, on which the animal glides slowly along. Snails and slugs possess this foot. Of the shell-covered molluscs some live in univalve, others in bivalve, or multivalve shells. To the bivalves belong, oysters, mussels,

and cockles; to the univalves snails, whelks, cowries, limpets, etc. The shells of the former class are joined by a hinge, and the inhabitant has the power of opening and closing the valves at will. Many of the inhabitants of the univalve shells have a horny or shelly plate attached to their bodies, which serves the purpose of a door when the animal retires within its house. This is well illustrated in the common periwinkle.

Mon'ey. [L. *moneta*.] Stamped metal, generally of gold, silver, or copper, used in traffic, or as the measure of price. The term *money* is now applied to whatever serves as a circulating medium, including bank notes and drafts, as well as metallic coins.

Mon'key. [Ital. *monicchio*.] The name of a family of animals found in the tropical parts of America, Asia, and Africa. They resemble man more than any other animals, both in their outward form and in their skeletons, and they sometime act very much like man. They live mostly in trees, which they climb with great ease. Their food consists of fruits, nuts, and insects. They are cunning and mischievous, and, if the higher apes be included, are the most intelligent of the animals below man. Many of the American apes have prehensile tails, by the aid of which they can swing from branch to branch.



MITRE BOX AND SAW

Mon'ogram. [Gk. *monos*, alone; and *gramma*, a letter.] One, two, or more letters interwoven as a cipher or abbreviation of a name, and used in seals, coats of arms, etc.

Monsoon'. [Ital. from Arab. = a time or season.] The wind that blows over the Indian Ocean from the north-east from October to April, and in the opposite direction during the rest of the year.

Month. [AS. *monadh*, from *mona*, the moon.] The twelfth part of the calendar year—popularly the space of four weeks. The *calendar* month has 30 or 31 days, except February, which has 28, and in a leap year 29; the *lunar* month is 29 days 12 hrs. 44 min. 2.684 sec; and the *sidereal* month is 27 days 7 hrs. 43 min. 11.545 sec.

Moon. [AS. *mona*.] The globe or satellite which moves round the earth and reflects the light of the sun upon it. In form it is an almost perfect sphere of 2,163 miles in diameter, and revolves at a mean distance from the earth's centre of 238,840 miles. The moon presents as large a surface to the eye as the sun, but it is really

many million times smaller, and looks as large only because it is so much nearer. It moves round the earth in a nearly circular orbit in a little less than a month. The time occupied by the moon in passing from one star to the same star again is called a *sidereal* month. For every revolution in the moon's orbit it rotates once on its axis, so that one side of the moon is always invisible to the earth. At times, however, owing to its vibratory motion, we see a little more than the side which usually faces the earth. When the moon is between the sun and the earth, it is invisible, and on becoming visible is called "the new moon," and when the earth is between the moon and the sun, the whole surface becomes visible, and in this state we have what is called "full moon." The interval from new moon to new moon again—that is, the time occupied by the moon in passing from the sun round to the sun again—is called the *synodic* month. It is longer than the sidereal month, its mean value being 29.53 days nearly, and this is the length of the *ordinary lunar* month. From "new" to "full" the moon increases in apparent size, and then begins to decrease in size, until it returns to the condition of the new moon. In the phases before and after new moon a faint illumination of the part not directly lighted up by the sun is visible. This is called the "earth shine," and is due to the reflection of light received from the earth. An eclipse of the moon takes place when it gets into the shadow of the earth, and an eclipse of the sun when the moon comes between the sun and the earth. To the naked eye the surface of the moon presents a mottled appearance, some parts being light and others dark. Viewed through a telescope the surface appears to be covered with mountains, valleys, and plains, like the surface of the earth; only in the moon everything is barren and desolate, like the country around volcanoes, and there are no seas, lakes, or rivers. The harvest moon is the full moon that occurs nearest the autumnal equinox (Sept. 23). (See *Eclipse*.)

Moose. The largest of the Deer family, equal in size to the horse, and standing very high. Its broad antlers weigh from 50 to 70 pounds. It is found in northern New England and Canada, and closely resembles the elk of Europe.

Mor'dant. [Fr., from L. *mordere*, to bite.] A substance, such as alum, for making colors firm and permanent. In *gilding*, the size used to make gold-leaf adhere.

Moroc'co. [*Morocco*, in North Africa.] A fine kind of leather made from goat-skin. It includes imitation French kid, brush kid, glazed kid, pebbles, straight-grained goat, and oiled goat. (See *Leather*.)

Mor'tar. [L. *mortarium*.] Sand with slaked lime and water, mixed thoroughly into a paste, and put between stones and bricks to fasten them together. (See *Cement*.)

Mor'tise. [Fr. *mortaise*.] A hole or hollow cut in one piece of timber to receive the end of another piece made to fit, called the *tenon*. The junction of the two pieces is called a *mortise-joint*, and

is much used in putting together the frames of houses, and in making doors and shutters.

Mosa'ic. [L. *musivum opus*, mosaic work.] Ornamental work formed of small pieces of colored marble, precious stones, or glass, laid in figures or patterns, attached by being bedded in cement.

Mosqui'to. [Span., from L. *musca*, a fly.] A species of gnat that abounds in marshes and woods, and whose sting is very painful. They are very widely distributed, being found in the coldest as well as in the hottest countries. A long proboscis or sucker projects from the head, with several little bristles or lancets sharper than the finest needle. These bristles prick the skin, and the insects draw up the blood through the proboscis, and a poisonous juice is squirted into the wound, which causes great itching, and sometimes a bad sore. It is supposed also that the microbe of malaria is thus implanted in the blood of man. Mosquitoes feed chiefly on the juices of plants, rarely on blood.

Mosses. (*Musci*.) A class of small flowerless plants, with simple branching stems and numerous narrow leaves. There are about 3,000 species, growing chiefly in cool and rocky regions, and also in bogs and swamps. Cold swamps are everywhere being filled with sphagnum and other mosses, whose remains accumulate, and are in time condensed to peat—a valuable fuel where wood and coal are scarce.

Moth. [AS.] An insect like a butterfly, but without thickenings on its antennæ, seen mostly flying about at twilight or during night. There are many kinds, and they vary in form, size, and color. The clothes-moth, the larvæ of which eat holes in clothing, carpets, and furs, is among the smallest of moths.

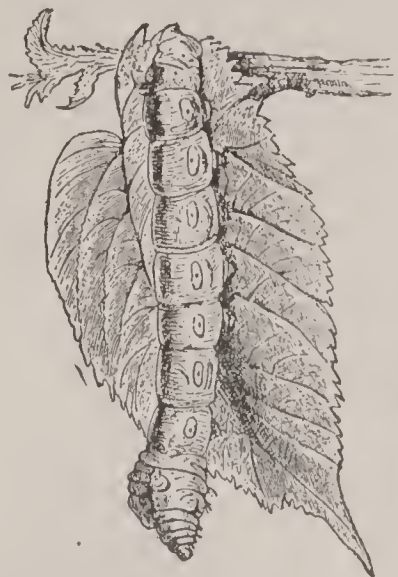
Moth'er-of-pearl. The hard, silvery, brilliant substance, called nacre, which forms an internal layer in several kinds of shells. Most of it is got from the shells of the pearl oyster, brought in considerable quantities every year from the East Indies, South America, and the Pacific Islands, and manufactured into knife handles, buttons, studs, and ornaments. It is also used in inlaying and for *papier-mache* work.

Mound Builders. The ancient Indians who erected the earth-mounds, so common in the Mississippi and Ohio Valleys. They are thought to have been the ancestors of some of the present tribes, especially those of the Southern States.

Mouse. [L. *mus*.] A small and well-known quadruped, found in almost all countries, and infesting dwelling-houses, granaries, and fields. The common house-mouse is a timid and harmless animal, but often does much mischief. The field-mouse and the harvest-mouse are the pests of farmers, causing much destruction of growing grain.

Mul'let. [Fr., from L. *mullus*.] A fish, often found in river-mouths and near the coast, which eats mud for the organic *debris* it contains, and is highly esteemed as food. The chief kinds are the red mullet and the gray mullet.

Mul'berry. [AS.] A genus of trees bearing a succulent mass of fruit of a purplish-black color and fine aromatic flavor. The fruit is much esteemed for dessert, and a pleasant light wine and an excellent preserve are made of it. The leaves of the mulberry are used for feeding silk-worms.



MULBERRY LEAF AND WORM.

Mule. [AS., from L. *mulus*.] An animal which is a half-breed between the male ass and female horse. The head, ears, and tail resemble those of the ass, but in bulk and height the mule is nearer the horse.

It is very sure-footed, and of great value for traveling in mountainous countries. Mules are largely used as beasts of burden in Spain, Portugal, Italy, and Spanish America; and in some of the southern States of North America they are employed for work on plantations. In recent wars mules have been found most useful transport animals.

Mul'ion. [Fr. *monlure*.] The upright bar or division between the lights of windows, screens, and panels in Gothic architecture.

Mum'my. The preserved body of a human being or animal. In Egypt the bodies were preserved by a process of embalming; and multitudes of mummies exist thousands of years old. In ancient Peru the same effect was produced by sun-drying. Dried bodies are also found in the Cliff Dwellings of the Western United States.

Mus'cle. [Fr., from L. *musculus*.] The fleshy parts of the body, which have the power of contracting and of moving the joints with which they are connected. Muscles are *striated* and voluntary, or *non-striated* and involuntary. They are composed of fibres laid side by side, forming bundles, which are attached to the bones by tough whitish strings called sinews or tendons. The various bones of the body are moved by about 400 muscles.

Mush'room. [Fr. *mousseron*.] A fleshy plant belonging to the fungi, with a short white stalk and a flat or rounded head, umbrella-shaped, which grows up in pasture-fields sometimes in a single night. Many kinds can be eaten, and some are used in making ketchup.

Musk. [L. *muscus*.] A substance with a strong and persistent odor, obtained from the male of the musk-deer, which inhabits the mountainous parts of Central Asia. Musk is one of the strongest of all perfumes, and is much used by perfumers.

Mus'ket. [Fr. *mousquet*.] The name formerly given to the common gun in the hands of soldiers, which was then discharged by means of a lighted match, but in which a spring-lock is now employed. (See *Rifle*.)

Musk=ox. A ruminating animal, between the sheep and the ox in character, found in the northern parts of America and even in the northernmost part of Greenland. Warmth is obtained from its very thick hair. When fat the flesh is well flavored, but musky in smell.

Musk=rat. The name of two distinct species of animals, one found only in America, much hunted for the sake of its fur, from 400,000 to 500,000 skins being annually imported into Britain; the other common in Europe. Both exhale a very strong odor of musk.



MUSSEL.

Mus'lin. [Fr. *mousseline*, from Mosul in Asiatic Turkey, where this cloth was first made.] A fine, thin kind of cotton cloth, of a light and soft texture, and not woven so compactly

as calico.

Mus'sel. [L. *musculus*.] The name applied to several common bivalve shell-fish, of which the common sea-mussel is the most important, and is largely used as bait for deep-sea fishing. In

some districts of Europe it is used as an article of food. Near Rochelle, in France, there are large "mussel farms," and hundreds of people are employed in planting and gathering the mussels.

Mus'tang. The name given to the small wild horses of Texas, California, Mexico, etc.

Mus'tard. [L. *mustum*.] The seeds of the mustard plant ground to powder and used as a seasoning for meat. The mustard plant is an annual, about 3 feet high, with sweet-smelling yellow flowers and seeds in little pods.

Myrrh. [L. *myrrha*.] A pleasant-smelling gum-resin obtained from the sap of the myrrh-tree, which grows in Arabia and Abyssinia. It is used in medicine as a tonic for disorders of the digestive organs, to cleanse wounds, and as a tooth powder when the gums are spongy.

Myr'tle. [L. *myrtus*.] A tree or evergreen shrub, with beautiful white flowers, shining leaves, and pleasant smell. The ancients considered it sacred to Venus, and her temples were surrounded by groves of myrtle trees.

N

Nail. [AS. *nægel*.] A pointed piece of metal, with a round or flattened head, used for driving into wood or other material for the purpose of holding separate pieces together. Formerly nails were made by the hand; complicated machinery is now employed in their manufacture. Nails vary in size and shape according to their different uses. They are now usually made of wire.

Nail. The horny scale on the fingers and toes of man. (See *Hoofs* and *Claw*.)

Nankeen'. [*Nankin*, in China.] A brownish-yellow cotton cloth made from a kind of cotton which grows in China. Imitations of this cloth are made in Great Britain and America, and are dyed yellow instead of being made of the cotton of that color.

Nap. [AS. *hnoppa*.] The soft downy surface of cloth; so called because, before it is dressed, it is composed of many little loops or knobs, which are afterwards cut and smoothed.

Naph'tha. [Pers. *nafata*, to exude.] A volatile bituminous liquid, of a strong peculiar smell, and very easily set on fire. When occurring naturally it is called rock oil or crude petroleum, and it is also obtained in the refinement of petroleum. It is used for illumination and to dissolve varnishes, etc. *Coal naphtha* is obtained by the distillation of coal tar, *boghead naphtha* from coal, and *wood naphtha* from wood.

Nap'kin. [Fr. *nappe*, a tablecloth; and *-kin*, little.] A small cloth; a cloth used for wiping the fingers and mouth at table.

Narcis'sus. [Gk. *narkissos*.] A class of bulbous plants to which daffodils belong, cultivated for the sake of their fragrant and beautiful cup-shaped flowers, which possesses narcotic properties.

Nar'whal. A marine mammal belonging to the Dolphin family, chiefly found in the Arctic seas. It is generally from 20 to 30 feet long, and is armed with a horny projection from the upper jaw, 6 to 10 feet long, and harder and whiter than ivory. It has sometimes two of these horns or tusks, but though thus armed is a very peaceable animal.

Nastur'tium. [L. *nasus*, the nose; and *torqueo*, to twist, in allusion to its pungent taste causing pain.] A plant cultivated both for ornament and use. It is a kind of cress, with white or yellowish flowers and a warm, pungent taste. The flowers are used in salads, and the seeds as a substitute for capers.

Nau'tilus. [Gk. *nautilus*, sailor, or shell-fish supposed to have a membrane which served as a sail.] A genus of shell-fish having a spiral shell, chambered with simple partitions perforated in the centre, concave towards the outlet of the shell. The outer chamber is the largest, and contains the body of the animal. The head of the animal has many simple tapered arms or tentacles. Four kinds are found living in the tropical Pacific, but there are many fossil kinds. It creeps along the bottom of the sea, and does not sail on the surface, as was formerly supposed.

Neb'ula. A vapory patch of seemingly gaseous matter seen in the heavens among the stars, and sometimes of immense dimensions. Many of the supposed nebulae have been shown to be clusters of very distant stars, but others are proved by the spectroscope to be made up of luminous gas. Great numbers of them exist.

Nee'dle. [AS. *nædl*.] The sewing-needle is a small instrument of fine steel wire, pointed at one end, with an eye at the other to receive a thread. In needles for sewing-machines the eye is at the pointed end. The *magnetic needle* is a

small piece of steel, pointed at both ends, and used in the mariner's compass. By its magnetic properties it is attracted and directed to the poles.

Nep'tune. The planet most distant from the sun, its distance being about 2,746,000,000 miles. Its diameter is about 37,300 miles, and its year equals 164.6 of our years. It has one known satellite, which revolves around it in a direction opposite to that of the satellites of the other planets.

Nerves. [L. *nervus*.] All the organs of the body are connected by nerves—each a bundle of nerve fibres enclosed in a special sheath—either with a great mass of nervous matter called the brain, or with a long thick nerve called the spinal cord, which runs down the centre of the back-bone. Delicate white threads or nerves pass from the brain through little holes in the skull to the ears, eyes, nose, mouth, etc. Long but very fine nerves extend from the spinal cord to all parts of the body. By the nerves sensations or feelings are transmitted to the brain. If the nerves going from the tip of a finger to the brain are cut, we can no longer feel anything with that finger. Again, if any part of the skin is touched, the sensation passes along a nerve to the spinal cord, and then up that great nerve trunk to the brain. But the nervous system does more than merely receive sensations. All the movements of the muscles are directed and governed by the nerves, and similarly the action of all the other organs of the body is under the control of the nervous system.

Net. [AS.] A fabric made of hemp, flax, or jute twine, and sometimes of cotton and other materials, worked into open meshes, and used in capturing fish, birds, butterflies, and small quadrupeds. Many kinds of nets are used by fishermen, but those most in use are the seine, drift, and trawl nets.

Net'tle. [AS. *netele*.] A genus of plants covered with extremely fine, sharp hairs, which pierce the skin when touched, and inject into the wounds an acrid juice, often causing much inflammation and pain. The fibre of the nettle is very strong, and in some countries it is woven into cloth. The stalks and leaves are used in some parts of England for the manufacture of *nettle-beer*.

New'el. The upright post about which the steps of a circular staircase wind; hence, in stairs having straight flights, the principal post at the foot of a staircase, or the secondary ones at the landings.

Newt. Any one of the several species of small aquatic salamanders; but the term is more commonly applied to the animals which inhabit ponds, wet ditches, and other damp places.

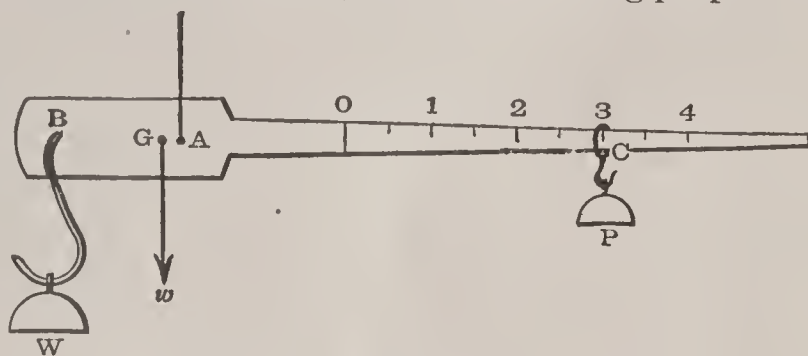
Nick'el. A metal discovered in 1751. It is of a silvery-white color, ductile, malleable, stronger than iron, and almost as hard to melt. Nickel is found in Russia, Norway, Germany, New Caledonia, Canada, and the United States. It does not tarnish by exposure to moist air, is very susceptible of magnetism, and magnets are made of it. Nickel is used for plating other metals, to

which it gives a beautiful silver-like surface that keeps them from rusting. Nickel is used with steel wrought into armor plates for warships. German silver is an alloy of nickel, copper, and zinc, and some white compounds used for small coins are similar alloys.

Night'ingale. [AS. *nihtegale*.] A small European bird, rather larger than the hedge-sparrow, of a rich russet-brown color, and noted for its vocal powers. It sings in the evening, and the sweetness of its song is celebrated by the poets.

Ni'tre. [Fr. *nitre*.] Saltpetre. A white crystalline salt, of a cooling, slightly bitter taste, unalterable in the air, and insoluble in alcohol. It is used in the manufacture of gunpowder, in the production of nitric acid, in medicine, as a fertilizer, and for preserving meat.

Ni'tric Acid. The most important oxide of nitrogen. Its chemical formula is N_2O_5 . It forms valuable compounds with most of the bases, and is useful also for its powerful oxidizing properties.



STEEL YARD, ALSO CALLED A BALANCE.

Ni'trogen. [Gk. *nitron*, nitre; and *gennao*, I produce.] The gaseous element which forms nearly four-fifths of the atmosphere. When alone or uncombined it does not possess any very active properties. In the air it serves to dilute the oxygen, which by itself would be too strong in its effects on life. Nitrogen is a colorless and transparent gas. It has neither smell nor taste, and it will not readily combine with other elements. It is very slightly soluble in water, and it is neither combustible nor a supporter of combustion, a lighted taper plunged into a jar containing nitrogen being at once extinguished. It forms many most important compounds, such as nitric acid, ammonia, and cyanogen.

Ni'tro-gly'cerine. A liquid appearing like a heavy oil, colorless or yellowish, and consisting of a mixture of several glycerine salts. It is produced by the action of nitric acid on glycerine in the presence of sulphuric acid, and is terribly explosive. When compounded with siliceous earth it forms *dynamite*, and with wood, *lignose*.

Nut. The fruit of certain trees consisting of a hard shell enclosing an edible kernel, differing in size from the beech-nut to the cocoanut—a piece of metal with a grooved hole, screwed upon the end of a screw-bolt.

Nut'meg. [Nut, and L. *muscus*, musk.] The kernel of the nut of a tree which grows in the East Indies, much used in cookery because of its pleasant taste and smell.

O

Oak. [AS.] The name of a noble genus of trees, sometimes styled the monarch of the woods. A large proportion of forest trees are oaks, of which there are about 300 different kinds, spread over nearly the whole of the northern hemisphere, except the extreme north. Some oaks shed their leaves every year, and some are evergreens, and the leaves are alternate, but often variously lobed. The timber of the oak is hard and tough, and has been used from the very earliest times as the best material for shipbuilding. It is also employed in architecture, cabinetmaking, mill-work, and coopering, and the bark is used in tanning and dyeing. It bears a well-known nut, called the acorn, which is contained in a small woody cup.

Oats. [AS. *ate*.] The grain of a corn-producing grass, which differs from wheat and barley in the loose arrangement of its spikelets on the stalk, forming what is termed a *panicle*. The oat is a hardy plant, well able to bear cold and moisture. Oatmeal is largely used in Scotland and in North America, and forms a very valuable article of food. Oats are excellent food for horses and cattle.

Obelisk. A tall, tapering, four-sided pyramid, cut off at the top in the form of a flat pyramid. Obelisks, made from single stones, of great height, stood before the temples of Egypt, their sides closely carved with hieroglyphic inscriptions.

Ocean. The great body of water which occupies five-sevenths of the area of the earth's surface, and surrounds all the continents. It is divided into the Atlantic, Pacific, Indian, Arctic, and Antarctic oceans.

Ocelot. A member of the cat family, smaller than the leopard and the ounce. It is about 3 feet long, and is found in America from Texas to Brazil, and in Sumatra. It climbs trees and feeds on birds and small animals.

Ochre. [Fr. *ocre*.] A fine kind of iron clay, either red (hematite) or yellow (limonite), used with size for painting.

Octopus. (See *Devil Fish*.)

Oil Well. A well sunk to underground beds of petroleum. It consists of iron pipes sunk into the earth, following a drill which cuts an opening downward. Some of these wells are sunk to a great depth, the total number in the whole earth reaching probably 100,000. The oil sometimes flows out and sometimes is obtained by pumping.

Oils. [Fr., from L. *oleum*.] Greasy substances expressed or drawn from various animal, vegetable, and mineral bodies, as olive *oil*, whale *oil*, rock *oil*, etc. They are used for food, for solvents, for anointing, lubrication, illumination, etc. The mineral oils are varieties of petroleum. The vegetable oils are of two classes—*essential oils* and *natural oils*, which in general resemble the animal oils and fats. Most of the natural oils and the animal oils and fats consist of ethereal salts of glycerine, with a large number of organic

acids, principally stearic, oleic, and palmitic, forming respectively stearin, olein, and palmitin. Mutton tallow, beef tallow, and lard are rich in stearin, human fat and palm oil in palmitin, and sperm and codliver in olein. Oils are classified according to their properties, and include—(1) non-drying oils, as almond, mustard, olive, etc.; (2) drying oils, as linseed, walnut, poppy, hemp, etc.; (3) train and fish oils, as seal, sperm, whale, cod, etc.; (4) vegetable fats, as palm oil, 'cocoanut oil, etc.; (5) animal fats, as lard, butter, tallow, etc.; and (6) waxes, as palm-tree wax, bees-wax, etc.

Olive. [L. *oliva*.] A tree or shrub with small oblong leaves, of which there are several species, the most important being the common olive, long cultivated in the south of Europe and Asia for its fruit. The olive has been much improved by cultivation. The oil is used in salads, in the arts, and in medicine, and the fruit for dessert purposes. Olive wood is very hard and is employed for cabinet-work.

Om'ellet or Om'ellet. [Fr. *omelette*.] A food compound, made with eggs beaten up with flour, etc., and fried in a pan.

On'ion. [Fr., from L. *unio*.] A genus of plants, which includes also the garlic, leek, and shallot. The onion is very extensively cultivated, and grows best in a rich and rather moist soil. Its root bears a round or oblong bulb, widely in use as a pot-herb and as a table food. It is very nutritious, and easily digested.

O'nyx. A variety of chalcedony with some resemblance to agate. It is made up of alternating parallel bands of different colors, and was used by the ancients in making cameos, the figures being cut in the white layers, while the darker layers formed the background.

O'pal. [L. *opalus*.] A mineral consisting of silica with a small admixture of alumina. Precious opal presents a fine play of colors, due to its great number of minute fissures, and is highly esteemed as a gem for setting in rings, brooches, and other ornaments. The finest opal comes from Hungary and Mexico. Common opal is semi-transparent, white, yellow, green, red, or brown, and has no play of colors.

Op'era-glass. A small double telescope, with concave lenses of low powers, for seeing clearly rather than magnifying objects at no great distance, such as scenery and buildings, and the interiors of operas, theatres, etc.

O'pium. [L. *opium*, Gk. *opion*, poppy-juice.] A vegetable extract which is the most active of all narcotics, and a valuable medicine. It is obtained from the dried juice of the opium-poppy, which grows wild in many parts of Asia, and is now largely cultivated in India, Persia, and China, and to a considerable extent in some parts of Europe. Much of the opium raised in India is sent to China, where it is largely used for smoking, with baneful effects. As a medicine it relieves pain, allays irritation of the nervous system, and produces sleep. Morphia is the

active principle, and the quality of the opium is judged by the quantity of morphia it contains. Laudanum, a crude preparation of opium in spirits of wine, is the form in which opium is very largely used.

Opos'sum. The name of several kinds of marsupial animals, found only in America. The best known is the common Virginia opossum, found all over the United States. In size it is about as large as a cat, but in shape more like a rat. It has short legs, a very long tail covered with scales instead of hair, except at its base, and a sharp rat-



like nose. In some opossums the pouch is absent. In several species the young are carried about on the back of their mother, and with their tails they cling to her tail, which is curved over her back.

Or'ange. [Fr. and Ital., from Pers. *naranj*, with *n* dropped.] An evergreen tropical and semi-tropical tree, seldom rising above 25 feet in height. The fruit is usually round, and consists commonly of ten pulpy parts enclosed in a leathery rind. The flowers, which are of a delicate white color, appear in summer, but the fruit is not ready for picking till the following year. Hence flowers and fruit in various stages may be seen on the trees at the same time. There are numerous varieties of the orange, which is cultivated in all the warmer regions of the earth. In the United States it is raised largely in Florida and California. The blood orange has a reddish juice. The mandarin orange is small, is thought to be of Chinese origin, and is counted a distinct species. The Seville or bitter orange is grown in large quantities in Spain, and imported into Great Britain and the United States for making marmalade. The rind is made into candied orange-peel. The leaf, the flower, and the rind of the fruit all yield volatile oils. The scent of *eau de Cologne* is due chiefly to oil distilled from the orange flower, while the rind of the bergamot orange yields *essence of bergamot*, largely used in perfumery.

Orang'-outang'. [Malayan = man of the woods.] An animal of the ape kind, found in Borneo, Sumatra, and Malacca. It is over 4 feet high, is reddish-brown and closely resembles man in many respects. It dwells only in forests, and moves rapidly from tree to tree.

Or'chid. A family of plants, distinguished by the singular forms of their flowers, which in some cases resemble a bird or an insect. They are prized for their beauty, fragrance and singularity.

Ore. The mineral from which metals are extracted. Metals usually exist in combination with oxygen, sulphur, or other elements; often with other metals. They are extracted from those compounds by the use of heat and various chemical processes.

O'sier. [Fr. *osier*.] The popular name of a species of willow, the long twigs of which are best adapted for basket-making and other wicker-work. (See *Willow*.)

Os'mose. The process which takes place when two fluids of different densities are separated by an animal membrane or by unglazed earthenware. They pass through the partition and mingle with each other, through the action of a kind of molecular attraction.

Os'prey. [L. *ossifraga*; *os*, a bone; and *frango*, to break.] A bird of the family *Falconidæ*, the bald buzzard, fishing-eagle, or fish-hawk, a large bird of prey, living upon fish, which it takes by darting upon them with great rapidity and true aim.

Os'trich. [Fr., from L. *avis*, a bird; and *struthio*, an ostrich.] The largest of all birds, attaining an average height of from 6 to 8 feet. It is a native of the sandy plains of Africa and Arabia. It has long and very strong legs, and only two toes, and is remarkable for its speed in running, and valued for its feathers. Ostriches live chiefly on fruits, grain, leaves, tender shoots, snails, and insects. They swallow stones to grind their food with in the gizzard, and have been known to gulp down pieces of iron, glass, leather, and other hard things. An ostrich egg is very large, weighing about 3 lbs., and is thus equal to about two dozen ordinary hen's eggs. The shell is thick and strong, and is much employed by the South African tribes for water-vessels. The ostrich is now domesticated in South Africa, and bred on farms for its feathers, oil, eggs, etc.

Ot'ter. [AS. *oter*.] A genus of carnivorous aquatic quadrupeds, included in the Weasel family. This animal is larger than others of that family, being often 4 feet long, and differs from them in living mostly in the water. Its paws are webbed for swimming, and its food is chiefly fish. Its fur is short, thick, fine, and quite handsome. Otters are found in almost all parts of the world. The American or Canadian otter is most plentiful in Canada, where thousands are killed every year for their furs.

Owl. [AS. *ula*.] A raptorial bird that howls or hoots at night. The owl has a short, stout form, downy feathers, and a large head with a flat face. The eyes are round and staring, and have a fringe of stiff feathers around them; and the bill is short, strong, and hooked. During the day owls hide away in trees, caves, and old buildings; and in the dusk of the evening, when they see better than in broad daylight, they fly around looking for game. Their food consists chiefly of rats, mice, moles, squirrels, and other

small quadrupeds; but they sometimes feed on other birds, and some of the smaller kinds eat moths, beetles, and other insects. They catch their prey with their claws, and swallow it whole at one gulp. There are many kinds—*barn, eared, hawk, horned, screech*, and *snowy* owls.

Ox. [AS. *oxa*.] The general name for the dif-



METAL BURNING IN OXYGEN.

ferent species and varieties of the ruminant quadrupeds belonging to the genus *Bos*. The species is distinguished by having smooth, hollow, persistent horns, growing on a bony core, by having the body thick and heavy, and the tail long, terminated by a tuft of hair.

Ox'ygen. [Gk. *oxus*, acid; and *gennēin*, to make.] A gas without color, taste, or smell, forming that part of the air which supports life and flame. It is also the principal component part of water. Oxygen readily combines with almost every other element. Not only does it form about one-fifth of the atmosphere, but it is also found in a great number of solid and liquid compounds. It has been estimated that this element alone forms about one-half by weight of the crust of the earth, being thus the most abundant of all the elements. When we see any substance burning, we may be certain that what we call *oxidation* is going on—that is, that the matter of the coal, or the candle, or the gas, or whatever it may be, is combining with the oxygen of the air, and in the act of doing so is producing heat and light.

Oys'ter. [Fr. *huitre*, from Gk. *ostreon*.] A genus of bivalve molluscs, much esteemed for food. Oysters are distributed very widely, and principally in the seas of warm and temperate climates. They are found on gravel and sand, in estuaries, and on the sea-coast, sometimes attached to rocks, trees, etc., at depths varying from the surface to seventeen fathoms. (See *Clams*.)

O'zone. [Gk. *ozein*, to smell.] A gaseous substance obtained from oxygen; so named from its peculiar odor, which resembles that of weak chlorine.

P

Pace. [Fr., from L. *passus*, a step.] The distance passed over in walking one step, estimated at $2\frac{1}{2}$ feet, but in measuring distances by stepping it is extended to 3 feet.

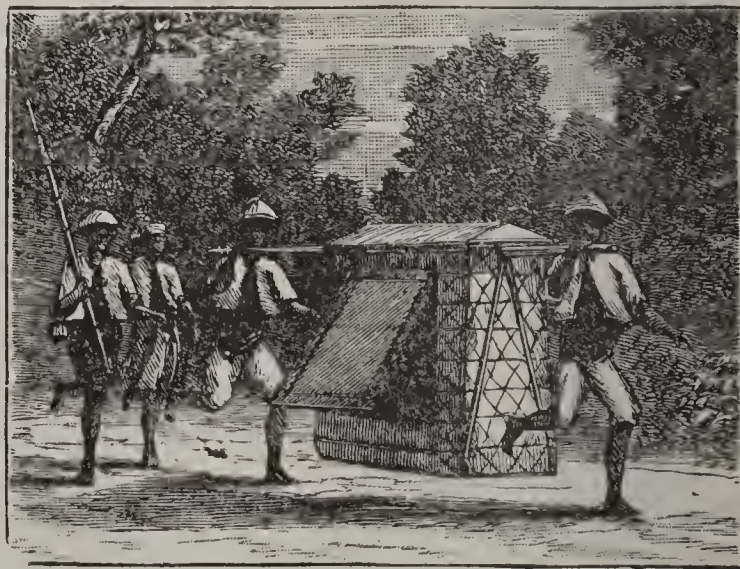
Pad'lock. A hanging lock with a clasp which turns on a hinge at one end, and, passing through a staple or link, receives the bolt through an opening in its other end.

Paint. [Fr., from L. *pingere*, to paint.] All paints are made up of the substance which gives the color, usually called the pigment, and that with which the color is mixed. Pigments are mostly made from minerals, but some are got from vegetables and some from animals. Paints are mixed either with oil or water, and are therefore called oil-paints or water-colors. Oil-paints are usually mixed with linseed oil, but sometimes some kinds of nut oils are used. Water-colors are mixed with water and a little glue or gum.

Palan'quin. A covered litter used in China, India, etc., borne on the shoulders of men.

Pal'ette. [Fr., from L. *paletta*, dim. of *pala*, a spade or shovel.] A little thin, oval board, or slab of ivory or porcelain, on which a painter mixes his colors, and which he holds by a thumb at one end.

Palm. [L. *palma*.] The name of about 1,000 species of plants growing in warm climates. Their stems are erect and slender, often lofty, and generally without branches, crowned at the summit with a tuft of large radiating leaves. Most of them are noted for the variety and utility



PALANQUIN.

of their products. (See *Cocoa*; *Date*.)

Palmetto. The common name of the palm trees which grow in the southern United States. There

are several kinds, but the cabbage palmetto, extensively cultivated in the south-eastern States, is the principal one. It grows to a height of from 20 to 30 feet. Its leaves are used for thatching buildings, and for making hats, baskets, mats, etc. As the ship-worm does not attack its wood, the timber is used for wharves and other wood-work under water.

Pam'pas Grass. A tall grass which covers much of the pampas, or great plains of South America. Its leaves, 6 or 8 feet long, hang gracefully over, while from the centre arises the flower-stems, 10 to 14 feet high. It is much cultivated in the north as an ornamental plant.

Pan'nier. [Fr., from L. *panarium*, a breadbasket.] A wicker basket; one of a pair of baskets slung over a horse's back, for carrying fruit or other light articles.

Pan'sy. [Fr. *pensee*.] A name applied to the varieties of *Viola tricolor*, etc., cultivated in gardens under the name of *heart's-ease*. (See *Violet*.)

Pantaloon'. One of the chief actors in a pantomime, who plays the part of a clown. He dresses in wide, long, garments—a kind of close long trousers, worn by males, extending from the waist to the feet.

Pan'ther. [Gk. *panther*.] A fierce flesh-eating African quadruped of the size of a large dog, spotted like a leopard, but darker in color. The *Puma* is often called the American Panther. (See *Leopard*.)

Pan'tomime. A theatrical exhibition in which there is no conversation, the plot being indicated by gestures and scenic effect. Its characters are taken by adepts in mimicry and gesticulation.

Papaw'. A small fruit tree of the south and south-west United States. Its fruit is a pod 3 or 4 inches long and an inch thick, with two rows of large flat seeds. It has a yellow skin when ripe, and looks something like a banana. Its flesh is softer and sweeter than the banana.

Pa'per. [L. *papyrus*.] Paper may be described as thin layers of fine vegetable fibre. It is made from the following materials: linen and cotton rags, refuse flax and hemp, jute, esparto grass, straw, soft wood, and waste paper. In America so considerable a quantity of wood is used that it is said the spruce is being depleted from many forests for this purpose. Esparto grass which grows in the south of Spain and the north of Africa, is the staple fibre used in Britain in the production of *machine-made* printing and ordinary writing-paper. Writing and printing papers can be made on the same machine, but their composition and character are totally different. *Printing-papers* require to be comparatively soft, open, and spongy, so as to absorb the ink freely; whereas writing-papers require to be stiff, hard, and non-absorbent. The best *writing-paper* is made wholly from rags, but very good is made from combinations of rags, wood, straw, or esparto. Names or devices or *water-marks* are put on the paper while it is traveling, in the form of half moist pulp, upon the "wire" of the paper-making machine. A light spider-ringed roll, covered with wire-gauze, and having the

name or device projecting from its surface, is made to revolve upon the top of the pulp, leaving its stamp or impression upon it; the water at the same moment being immediately withdrawn, leaves the depression permanent, and thus water-marks are simply thin portions of the sheet, varying in outline as letter or device stamps itself upon the pulp on the machine. The webs of paper from the machine are then cut into sheets of different length and width as required, and examined for imperfections. The recent development of book illustration requires a highly-finished paper, which is passed through a slight mist or fine spray and then run through a super calender. Writing-paper is glazed under heavy pressure between sheets of copper or zinc.

Pap'ier=ma'che. [Fr. *papier*, paper; and *mache*, mashed or chewed.] Paper mashed into pulp, and after being mixed with size or glue formed into various shapes by molds—as tea-boards, trays, and ornamental articles—and japanned when dry.

Par'achute. [Fr. *parer*, to guard; *a*, against; and *chute*, a fall.] An instrument in the form of an umbrella, which enables a person, by its resistance to the air, to drop down safely from a balloon.

Par'affin. Fr., from L. *parum*, little; and *affinis*, related to.] A white substance of the nature of wax. It is got from shale, coal-tar, petroleum, etc., and is *unattacked* (hence its name) by such powerful oxidizing agents as nitric and chloric acid. The lighter and more volatile portions of petroleum are used as solvents for gums, fats, resins, etc.; and the less volatile portions are used for illuminating and for lubricating, or are converted into *vaseline* or *paraffin* wax, from which candles are made.

Parch'ment. [Fr., from L. *pergamena*; *Pergamos*, in Asia Minor, where it was first made about B.C. 190.] The skin of a sheep or goat dressed and prepared for writing on. Parchment used for covering drums is made from the skins of asses, calves, or wolves, those of wolves being the best.

Par'rot. [Fr. *perroquet*.] The type of a large group of tropical birds, of numerous species, noted for their beautiful color and powerful hooked and projecting bill, which is used for crushing seeds and fruits. Parrots use their bills as well as their claws in climbing trees, and use their feet to carry food to their mouths. Those usually kept as pets are the South American parrot, and the gray parrot, with scarlet tail, from West Africa. The latter is noted for its tameness, mischievousness, and power of imitating sounds. It is easily taught to whistle and to speak. Parrots live to a great age, instances being on record of these birds attaining an age of seventy or more years.

Pars'ley. [Fr., from Gk. *petros*, rock; and *selinon*, a kind of parsley.] An aromatic herb, with finely-divided leaves, used for seasoning soups and for dressing dishes. It is a native of the south of Europe.

Pars'nip or Pars'nep. [L. *pastinaca*.] An aromatic herb, cultivated for the sake of its root, which resembles a carrot, and is highly nutritious.

The flesh of cattle fed on parsnips is excellent, and the butter of dairy cows fed on them is superior to that produced by other kinds of winter feeding.

Par'tridge. [Fr., from Gk. *perdix*.] A family of birds which includes also the quail. The common or gray partridge is found throughout Europe. Its flesh is much liked, and the bird is the delight of the sportsman. The red-legged partridge of southern Europe is found also in Asia. In the United States the quail is often called by the name of partridge. The partridge of New England is the ruffed grouse; the spruce partridge is the Canada grouse.

Pas'sion-flower. A beautiful climbing plant, remarkable for the elegance and singular form of its flowers, which resemble "a crown of thorns." The roots and leaves are noxious, and are used in medicine.

Pea. [AS., from L. *pisum*, a pea.] A garden and field plant of many varieties, with a papilionaceous or butterfly flower, and fruit in a legume or pod. It is supposed to belong to the south of



THE OSTRICH.

Europe, and has been cultivated in the East from remote antiquity. It is now one of the most common of garden plants, and is largely grown by market-gardeners, who find it a most profitable crop. As an article of food peas are very valuable, containing a large percentage of *casein*, which is a flesh-forming principle.

Peach. [Fr., from L. *Persicus* = *Prunus Persica*, the Persian tree.] A well-known tree and its fruit, a native of Persia, largely cultivated throughout Europe and the United States. The peach tree is of medium size, with finely-serrated leaves and beautiful flowers, which appear before the leaves and diffuse an agreeable odor. The fruit is one of the most exquisite and delicious of temperate climates. In several of the United States there are immense orchards of peaches, and large quantities are sent to the northern markets, while the canning and drying of the fruit form an important industry.

Pea'cock. [AS., L. *pavo*, a peacock.] One of the most beautiful of birds, of a nature similar to the pheasant, with a tail of very long, bright feathers. It is elegant in form and graceful in its movements, with a splendid crest or tuft on the head, while the feathers of its tail are of an emerald green, purple and gold, studded with richly-shaded eye-like markings, and are capable of erection. The female birds are smaller, and not nearly so handsome, being of a sombre brownish plumage, and presenting a striking contrast to the brilliant appearance of their mates. The cry of the peacock is very harsh and loud. Wild peacocks are still plentiful in many parts of India, and in Java, Sumatra, etc., and in these places hunting them forms a favorite amusement of the sportsman. The feathers of the peacock are used for trimming clothes and fans, and for ornamental brushes. Its flesh was eaten in ancient times. The Romans used to think it a great delicacy, and the emperors had dishes served at their feasts made entirely of the brains and tongues of peacocks. But peacocks are not much eaten now, as their flesh is not so good as that of the turkey and other fowls.

Pea'nut. The fruit of a leguminous plant growing in warm countries—also called ground nut and earth nut. The plant is a trailing vine, with small yellow flowers. After the flowers fall the stem lengthens, bends downward, and the seed-pod on its end forces itself into the ground, where it ripens. Peanuts are raised in immense quantities in western Africa, South America, and the southern United States. They are used for food, and yield an oil resembling olive oil.

Pear. [AS., from L. *pirus*, a pear-tree.] The pear-tree is very largely cultivated for the sake of its fruit. The tree grows wild in many parts of Europe, and is now cultivated in all temperate climates. It sometimes attains a height of 40 feet, with a trunk from 2 to 3 feet in diameter. The varieties of pears are very numerous, and though many of them are of little consequence, more than two hundred at the present day are enumerated as fit for the table, and new varieties are being added every year. Pears are preserved by canning, like peaches. The wood of the pear-tree is hard, fine-grained, of a yellowish color, and susceptible of a brilliant polish. It is largely used by turners, and sometimes dyed black and used by cabinet-makers for ebony.

Pearl. [O.E. *perle*.] A white, hard, smooth, shining substance, found in some shell-fish, especially in

the pearl-oyster, river-mussel, and certain univalves. It is highly valued for its beauty, and used as a jewel. The shells are lined with a secretion of extremely thin semi-transparent films, and in due time layers of considerable thickness are formed, which gradually harden into the material known by the name of *nacre*, or mother-of-pearl. Besides the pearl lining of the shells, rounded portions of nacre or *mother-of-pearl* are found in the flesh of the oyster. These are supposed to be formed by the intrusion of some foreign body, such as a grain of sand, around which layers of nacre are deposited one after another, as many as from ten to twelve round pearls of different sizes being often found within one shell. The best pearls are found off the coast of Ceylon, in the Persian Gulf, on the coast of Australia, and on the Pacific coast of America. The pearl-fishing season lasts from four to six weeks. A fleet of about 250 boats is engaged in the fishery, each boat having a crew of thirteen men and ten divers, five of the latter being employed in diving whilst the other five are resting. The work is done very rapidly, as the divers cannot remain much more than a minute under water. Each diver is let down from the boat by a rope, weighted with a stone. The usual depth is from 60 to 70 feet. The most valuable pearls are those which are perfectly round; but these are very scarce, and secure high prices. They are used to form the centre of necklaces. Pearls have been prized as articles of decoration and ornament in all ages of the world. Cleopatra is said to have owned two very large and beautiful ones. Many splendid pearls are owned by the different crowned heads of Europe; but the Shah of Persia is said to have the finest.

Peat. [For *beat*; AS. *betan*, to make *better*, to mend (a fire). Same root as *better*.] A vegetable substance found amidst much moisture, as in marshes and morasses, and made up of roots, stems, and fibres in every stage of decomposition. When cut and dried it is often used for fuel in many places where wood and coal are scarce. The use of peat as fuel in the distillation of Scotch whiskey gives it its peculiar flavor. Charcoal made from compressed peat is superior to wood charcoal, and is capable of being used for smelting iron.

Pec'cary. An American animal allied to the hog, but smaller. There are two species. One—about 3 feet long—extends from Arkansas to Patagonia, the other from Central America to southern Brazil. The latter is extremely pugnacious and its herds are dangerous to meet. Even the jaguar retires before several of these animals banded together.

Pel'ican. [L. *pelicanus*.] A large web-footed water-bird, remarkable for its long, large, flattened bill, to which is attached a bag or pouch for holding the fish taken for food. Pelicans live along the shores of seas, lakes, and rivers. They hover over the water in search of prey, and plunge upon it when it appears, storing it in their pouch until it is full, when they go to some

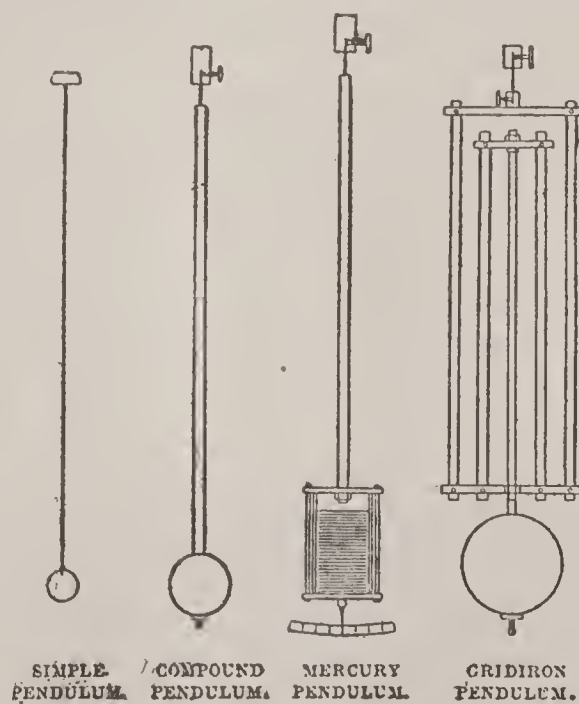
lonely place to bring it out at leisure to eat or to feed their young. Pelicans are natives of the eastern parts of Europe, and of many parts of Asia and Africa. The American white and brown pelicans abound on the Florida coast in winter, but breed on the North American lakes.

Pen. [L. *penna*, a feather.] An instrument for writing with a fluid ink. In ancient times, pens were made out of reeds; but after paper came into use they were made from quills, generally those of the goose and swan, and for extremely fine writing those of the crow. The manufacture of pens from steel was commenced about the beginning of the nineteenth century. Machinery is now largely used in the manufacture of pens, but the finer qualities are finished by hand labor. An ordinary steel pen has to go through some sixteen different processes; while the gold pen, which is incorrodible with ink, and very largely manufactured in the United States, goes through no less than forty-five different processes.

Pen'cil. [L. *penicillus*, a small tail or brush.] A pointed strip of black lead, colored chalk, or slate, usually enclosed in a slight rod of wood, for drawing and writing; but the term is also applied to small hair brushes used by artists, and it was to these that the name was originally given. The best lead pencils are now made in the United States, the purest black lead or plumbago being found there. The wood used for pencils is invariably that of the Virginia or Florida cedar. Colored pencils are prepared by the use of various chalks instead of graphite. The chalk is reduced to powder, mixed with a little hot melted wax, and then pressed and cut into strips of the size required. Slate pencils are thin strips of slate cut out and afterwards rounded. The strips are sometimes cut very thin and put into wood casings like lead pencils.

Pen'dulum. [L. *pendulus*.] An instrument consisting of a weight suspended from a fixed point, and free to swing to and fro by the alternate force of momentum and gravity. It is used to regulate the movements of clock-work and other machinery. The principal kinds in common use are—the simple, the compound, the mercury, and the gridiron pendulums.

Pen'guin. A genus of swimming birds included in the Auk family. Penguins exist in large numbers in the Antarctic seas, and along the southern coasts of Africa and South America.



Their front wings, which are without true quills, are too short for flight, and are used as fins or paddles in swimming under water. On shore these birds present a singular appearance, standing erect in long regular lines, resembling files of soldiers. The plumage of the neck is valued for collars and tippets, and large numbers are slaughtered annually.

Pen'ny. [AS.] An English coin, formerly of copper, now of bronze, worth one-twelfth of a shilling. In the New Testament a silver coin of the value of about $7\frac{1}{2}$ d. In the United States the name *penny* is often given to the *cent*, a coin of half the value.

Pennyroy'al. A kind of mint found in Europe and very fragrant. The United States pennyroyal is not a mint, but its scent is like that of the European plant and it has the same uses. A tea is sometimes made from it, and its oil is used to drive away flies and mosquitoes.

Pepper. [AS., from L. *piper*.] A common kind of spice, the dried berry of a climbing shrub which grows wild in the East Indies, but is now cultivated in most hot countries. The peppers of Malacca, Java, and especially of Sumatra, are the most esteemed. The berries are about as large as peas, and grow in clusters of twenty or thirty, somewhat like a bunch of currants, each berry containing a single seed. *Cayenne pepper*, first brought from Cayenne, in South America, is made from the pod of the capsicum plant, an entirely different kind of shrub from that which bears black pepper. The pod is green at first, but bright scarlet when ripe, and this gives the pepper its red color.

Pep'permint. A small herb, of a strong spicy odor, much used for flavoring. This, with the spearmint and the pennyroyal, is used in medicine for its stimulant and carminative properties. Others of the mint family are the horse-mint, the brook-mint and the corn-mint, the latter smelling like decayed cheese.

Pep'sin. [Gk. *pepsis*, cooking; *pepten*, to digest.] The active agent in the gastric juice of many animals. For use in drugs it is obtained from the glandular layers of pigs' or calves' stomachs.

Peram'bulator. An instrument for measuring distances, made up of a wheel with an apparatus of clock-work, and a dial-plate upon which the distances traveled are shown by an index; also the name given to a child's carriage, pushed forward by a person walking.

Perch. [Fr., from Gk. *perke*.] The name of several species of fishes of the genus *Perca*, frequenting the fresh waters and coasts of temperate and tropical regions. The fresh-water perch is widely distributed in lakes, ponds, and rivers in Europe, Asia, and North America. It is greenish yellow on the back, and bright yellow on the sides, which are marked with from five to seven blackish bands. The perch is very voracious, devouring smaller fishes, insects, worms, etc. It can exist out of water for a considerable time.

Per'fumes. [Fr., from L. *per*, through; and *fumare*, from *fumus*, smoke.] Scents made from sweet-smelling substances. They are ob-

tained chiefly from plants, but some are got from animals. Vegetable perfumes are made from flowers, herbs, spices, seeds, gums, certain fruits and nuts, and various woods. Perfumes of animal origin are obtained from the musk, ambergris, civet, and castor. Dry perfumes, such as incense and *sachet* powders, are simply gums, resins, dried herbs, etc., pounded or ground to powder. Liquid perfumes are mostly distilled from the different parts of plants. Such perfumes are called essential oils. But the perfumes made from flowers, such as are used on the handkerchief, are mostly made, not by distillation, but by maceration and absorption.

Per'iwinkle. [AS. *pinewincla*.] A sea-snail or small shell-fish, found in abundance between tide-marks on rocks or adhering to sea-weeds. Periwinkles feed on sea-weeds, and are often collected and boiled in their shells, from which they are afterwards extracted and used for food.—Also a trailing herb of the genus *Vinca*.

Per'ry. The fermented juice of pears, prepared in the same way as cider, and used as a beverage.

Persim'mon. A tree bearing a small, rounded fruit in the United States; also in Japan. The fruit is yellow and pulpy, and when unripe is highly astringent, but is sweet and palatable after being frosted. A kind of liquor is made from persimmons.

Pet'rel. [Perhaps from the apostle Peter's walking on the sea.]



A genus of sea-birds allied to the gulls. The best-known species is the stormy petrel, well known to seamen as Mother Carey's chicken. The appearance of these birds is considered to presage a storm, and they are often seen during storms at

sea skimming over the surface of the water as if walking on it. Their food consists of small marine animals and seeds of sea-weeds, and they appear fond of fat or grease, for which they will follow in the wake of ships for great distances.

Petro'leum. [L., from Gk. *petra*, a rock; and *oleum*, oil.] Rock-oil, an inflammable liquid which exudes from the earth in various parts of the world. Petroleum has been known since the most ancient times, but it is only recently that its importance as a commercial production has been discovered. It is found in great quantities in the United States and at Baku, Russia, and in smaller quantities in several other countries. The oil is generally got by sinking deep holes, called wells, into the earth. In some of these wells the oil rises up and flows over, being forced out by a kind of gas; but in others the oil has to

be pumped out. In the oil-region in Pennsylvania there are now several thousand wells, some of which are more than a thousand feet deep. There is always a good deal of what is known as natural gas associated with petroleum. This gas is made up of carbon and hydrogen, and burns very brightly. It is carried in pipes to neighboring towns and used for domestic and manufacturing purposes. At one time Pittsburg used 500,000,000 cubic feet daily in its factories and houses.

The oil from the wells flows into large tanks, from which it is carried in iron pipes to the shipping places and places where it is to be refined or purified. There are more than two thousand miles of these pipes laid in the Pennsylvania oil-region, and they reach from there to Philadelphia. At the refineries the oil is distilled and separated into oil for illuminating purposes, commonly called kerosene oil; naphtha, used in making oil-cloths, and sometimes as a burning fluid; benzine, used in making paints and varnishes; gasolene, used for making gas and for mixing with coal gas. (See *Naphtha* and *Paraffin*.)

Pew'ter. [Ital. *peltro*.] A common and very useful alloy, consisting mainly of lead and tin, improved in hardness and color by the addition of a little antimony, bismuth, and zinc. Britannia metal is a kind of pewter, made of tin and antimony, with a little zinc and copper. It is harder than common pewter, has a very fine silver-looking appearance, and is largely used for making tankards, coffee-pots, tea-pots, soup-tureens, and other table dishes.

Pheas'ant. [L. *phasianus*.] The name of a family of birds, natives of Asia. The common pheasant, has been domesticated, but not successfully in this country. Some species are remarkable for their great beauty of plumage.

Phlox. A very ornamental North American genus of plants, bearing handsome flowers, of which many attractive varieties have been produced by the florist.

Phœ'nix. A fabulous bird of antiquity, eagle-like in form, and with gold and crimson plumage. It was said to live 500 years in the desert, then return to Egypt and build a nest. In this it was consumed, and a new bird sprang from its ashes. The word is now used in a metaphorical sense, to indicate the springing of the new from the old.

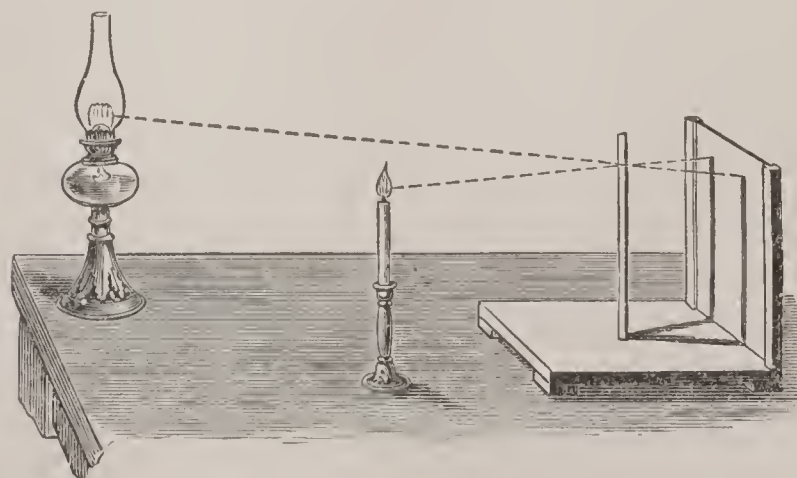
Phon'ograph. [Gk. *phone*, a sound; and *graphein*, to write.] The phonograph, invented by Mr. Edison in 1877, is an instrument which mechanically records and reproduces articulate human speech, song, etc. Speaking in front of this instrument, a thin iron plate having a blunt steel point or pen fixed at its centre is made to vibrate; the steel point by means of an ingenious mechanism, chronicles the vibratory movements by indenting a sheet of tin-foil, wax, or paraffin, with which it is brought into contact. The slip thus marked is then removed, and may be sent to any distance, or kept for a number of years, when it has only to be placed on a similar phonograph, and the operations

reversed, in order to produce similar vibrations, which exactly reproduce the voice and the words originally spoken. The message can be read off as often as desired, until the indentations are worn out.

Phos'phate rock. A mineral, of organic origin, found in South Carolina and Florida, and to a smaller extent in other parts of the world. It is dug up and ground, and used for a fertilizer, it being rich in fertilizing properties.

Phos'phorus. [Gk. *phos*, light; and *phoros*, bringing.] A yellowish element resembling fine wax, which must be preserved under water. It is easily set on fire, and gives out a faint light in the dark. It is used for the tips of matches. It is found in the seeds of plants and in the nerves, bones, and other parts of the animal body. Phosphate of lime is abundant in bones, and from these phosphorous is now obtained.

Photog'raphy. [Gk. *phos*, light; and *graphein*, to write.] The science or art of taking representations of objects by the action of light on a prepared surface. The surface, consisting of metal, glass, paper, or other suitable substance, is prepared by being coated with collodion or gelatine, and sensitized with the chlorides, bromides, or iodides of silver, or other salts sensitive to light. The picture obtained in the camera by means of exposing one or other of these sensitive surfaces to the light cannot be seen when the plate is removed, but by pouring over it a mixture of ferrous sulphate or pyrogallie acid it comes out little by little. This is called developing the picture. Any excess of unchanged sensitive salt is then dissolved off with sodium hyposulphite or other suitable reagents, and in this way the negative image is fixed, from which any number of positive prints may be taken, which are washed, toned, fixed, and then mounted.—*Photogravure*, a print from a copper or steel plate. The picture is produced on the plate by photography, and bitten in with acid instead of engraving.—*Photo-lithograph*, a lithographic picture or copy from a stone prepared by the aid of photography.



Photom'eter. An instrument for measuring the relative intensity of light, or for comparing the intensity of two lights. The unit is the light of a candle. The incandescent electric light is measured in this way, and the glass bulbs are marked 8-12-16-32 candle power.

Phy'salia. The Portuguese man-of-war, a singular ocean animal, consisting of a pear-shaped air-sac, with a handsome crest, which floats on the surface, and from which depend a large number of long tentacles. The sac is 3 or 4 inches long, and some of its tentacles are 30 feet long.

Phy'sics. The class of sciences which include the forces or properties of matter and motion, as electricity, magnetism, light, heat, and gravitation.

Pianofo'r'te. A musical instrument consisting of a number of tightened wires of different lengths and thicknesses, struck with small hammers worked by keys; so called because it can produce both *soft* and *loud* tones.

Pig'eon. [Fr.] A genus of birds found in all parts of the world, there being nearly 500 different kinds. Their wings are strong, and they can fly great distances. The wild pigeon, or *passenger pigeon*, is about the size of a turtle-dove, but with a long wedge-like tail. There are numerous varieties produced by domestication, including the *fantail*, the *tumbler*, the *pouter*, etc. One of the most important of these is the *carrier pigeon*, which is capable of flying long distances at rapid speed. These birds are noted for their love of home, and they will find their way back even when taken hundreds of miles away. For this reason they have been used from the most ancient times for carrying letters, and it is from this that they get their name.

Pike. The common name of a family of well-known fresh-water fish, abundant in the temperate parts of Europe, Asia, and America. They are strong fish, rapid swimmers, and the most voracious of fresh-water fishes, living mostly on other fish. They possess a long, sharp jaw or snout, which is like a pike or spear. The common pike occurs in the rivers of Europe and North America, and is accounted exceedingly wholesome.

Pil'chard or Sardine. A fish resembling the herring, but smaller, thicker, and rounder, found in abundance off the coasts of Devon and Cornwall, England. Most of the pilchards landed there are salted and sent to Spain, Italy, and France. They are packed in hogsheads, each containing about 3,000 fishes, and from 12,000 to 15,000 hogsheads are annually exported.

Pile. [AS. from L. *pilum*, a pike.] A large pointed log of wood driven into the earth to support the foundations of a building, or used in engineering operations, such as making drains, bridges, and roads. Piles are driven into the ground by machines called pile-drivers, worked usually by steam. A heavy weight is raised to a considerable height between two tall posts, and then let fall on the head of the pile.

Pin. Pins were formerly made by hand, and the heads were put on separately, but solid-headed pins are now made by machines. The pin-machine, an American invention, patented in England in 1824, makes the whole pin without any help from the workman. Ordinary pins are made of wire, of the thickness required. Black

pins are made by boiling brass pins in japan varnish instead of with tin.

Pine. [AS. *pin*, from L. *pinus*.] The name of a family of cone-bearing trees, found in Europe, Asia, and America, growing chiefly in mountainous or other exposed situations. Their leaves are needle-shaped, growing in clusters or in pairs, and surrounded with little scales at their base. The most important species is the American white pine, widely used in carpentry from the softness and ease of working of its timber. Other species are the red Canadian pine, the yellow pine, the nut pine, the sugar pine, and the pitch pine. Under this name are sometimes included spruces, firs, larches, and true cedars (*q. v.*).

Pine=apple. The fruit of a plant of the same name, a native of tropical America, now largely cultivated in most hot countries. The plant has many long, stiff, sharp-pointed leaves, from the middle of which grows a short stem bearing a single fruit, in shape like the cone of a *pine*. Pine-apples are sent from the West Indies and Azores to all parts of the world, and are much valued as a fruit for dessert and for preserving. A spirituous liquor called pine-apple rum is made from the juice of the pine-apple in some warm countries. The leaves of the plant contain fine fibres or threads, from which is made the beautiful pine-apple cloth. This is largely manufactured in the Philippine Islands.

Pink. [*Dianthus* = the flower of Jove, or God's own flower.] The garden pinks and carnations, so varied in form and coloring, are supposed to have descended from a single species, known in Europe as *clove pink*, a native of the southern Alps. There are now nearly 400 varieties. The roots are annual or perennial, the stems herbaceous and jointed, bearing a pair of opposite, linear, apparently veinless leaves at each joint. The flowers have peculiar grace and fragrance. The carnation and picotee are modifications of the clove pink.

Pin'nace. [Fr., from L. *pinus*, a pine tree.] A small ship, having sails and oars, used as a tender to a larger vessel, and chiefly employed to obtain intelligence and to land men; also a man-of-war's boat.

Pipe. [AS.] A tube made of various materials—as earthenware, wood, metal, leather, gutta-percha, etc.—for the conveyance of water, steam, gas, or other fluid; used for a great variety of purposes in the arts and in domestic economy. Tobacco-pipes, used in smoking tobacco, usually take the form of a bowl and connecting tube, and are made of baked clay, porcelain, stone, meerschaum, wood, and various metals. Meerschaum pipes are beautifully carved. Pipe-stems are made of cane, and of cherry, elder, jasmine, and other woods; mouth-pieces are usually of bone, amber, ivory, and sometimes of silver. (See *Meerschaum*.)

Pis'tol. [Fr., from Ital. *Pistola*, a town in Italy, now *Pistoja*.] A small fire-arm that can be held in one hand while being fired; said to have been first made at Pistoja. (See *Revolver*.)

Pis'ton. [Fr., from L. *pistus*, *pinsere*, to beat. Same root as *pestle*.] A solid piece of metal or other material, in the form of a short cylinder, attached to a rod called the *piston-rod*, which in its turn is attached to the adjoining machinery. It is made to fit exactly the cavity of a pump, tube, or other cylindrical space, in which it works up and down alternately, and is employed in forcing some gas or liquid into or out of the tube which it fills, as in steam-engines, fire-engines, and pumps (*q.v.*).

Pitch. [L. *pix*.] A thick, black, sticky substance got by boiling down tar, used for coating ropes, canvas, etc., and by ship-builders for filling up the seams and coating the outsides of ships and boats.

Plaice. (L. *Platessa*.) A common flat fish, somewhat like a flounder. The sides of the body are more compressed than in other fishes. It is caught in large quantities in European waters as a food fish.

Plane-tree. [Fr., from L. *platanus*.] A tall spreading tree, with broad leaves shaped like an open hand, and seeds united in little globular pendent balls. The best-known species are the Oriental or Asiatic plane-tree, and the Occidental or American, which is also called the button-wood and sycamore. It grows almost all over the United States east of the Rocky Mountains. It is occasionally more than 100 feet high and from 12 to 15 feet thick, and makes an excellent shade tree. Its wood is hard and close-grained, and largely used for joiners' work.

Plant. [AS., from L. *planta*, a plant.] An organized living thing, generally without feeling or voluntary motion, with a root, stem, and leaves, though consisting sometimes only of a single leafy expansion. Plants grow in a great variety of forms, such as trees, shrubs, herbs, grasses, ferns, mosses, lichens, etc. Trees and shrubs are called perennials, because they live on through many years. Herbs are divided into annuals, biennials, and perennials. All parts of a plant—root, stem, leaves, flowers, and fruit—are made up of cells of different kinds, and by means of these the plant lives and grows. The food of plants is partly gaseous and partly liquid. The gaseous food is carbonic acid, which they get chiefly from the air, and take in principally by their leaves. The liquid food is water, which they take up mostly through their roots. Most plants grow from seeds, and although all do not bear true flowers and real seeds, they all have something which answers for seeds. Thus we have flowering plants and flowerless plants. The former class includes almost all trees, shrubs, and herbs; while ferns, mosses, sea-weeds, lichens, and fungi constitute the latter. Flowering plants are divided into two classes, which differ from each other in stems, leaves, and seeds. These classes are further divided into orders or families, each of which is named after some chief plant of its order—as the Oak family, the Pine family, the Rose family, etc.

Plan'tain. [Sp. *plantano*.] A plant or tree and its fruit, of the genus *Musa*, found in the countries

of the torrid zone. The plantain attains a height of from 15 to 20 feet, with leaves often more than 6 feet long and nearly 2 feet broad. Its fruit is extensively used as food. (See *Banana*.)

Plas'ter. [L. *emplastrum*, with *em* dropped.] A mixture of lime, sand, and water, employed in overlaying the interior and exterior faces of walls. *Plaster of Paris*, sulphate of lime—a powder extensively employed in making casts of statuary.

Plate-glass. A fine kind of glass (*q.v.*), cast in plates, used for looking-glasses, etc.

Plat'inum. [Span., from *plata*, silver.] A comparatively rare metal, found only in the native state, commonly in grains, scales, or nuggets, and generally alloyed with five other metals—namely, palladium, rhodium, iridium, osmium, and ruthenium. It is obtained chiefly from the Ural Mountains, and in smaller quantities in Brazil, California, Ceylon, and Borneo. Platinum possesses a dull white color, and does not tarnish under any circumstances in the air. It is heavier than gold, as soft as copper, and may be hammered into thin plates and drawn out into fine wire. It is very infusible, and can only be melted by the heat of the oxy-hydrogen blow-pipe. It is used for electrical and chemical apparatus, and since the introduction of platinotype processes in photography the metal has very much increased in price.

Plov'er. [Fr., the rain-bird; from L. *pluvia*, rain.] A genus of wading birds, which are found in every quarter of the globe. Many of them are birds of passage, and they are prized as game birds. Among the more important species are the black-breasted plover and the golden plover of Europe and America, the ringed plover, Wilson's plover, the stilt plover, and the lapwing. (See *Lapwing*.)

Plum. [AS., from L. *prunus*.] The name given to a tree or shrub and its fruit. It belongs to the genus *Prunus*, of which there are several species. From 200 to 300 varieties of plums are derived from the *Prunus domestica* species. Among the best known are the *green gage*, the *Orleans*, the *damson*, the *purple gage*, and the *German prune*. Plums are much used for dessert, and are made into preserves and prunes.

Plumb. [L. *plumbum*, lead.] A little weight of lead attached to a line, and used by builders, etc., to indicate a vertical direction. *Plumb-line*, the cord by which a plumb-bob is suspended.

Plumba'go. [L. *plumbum*, lead.] Native carbon in hexagonal crystals, of black color and metallic lustre, and so soft as to leave a trace on paper. It is used for pencils, for crucibles, and as a lubricator.

Plum'met. A piece of lead attached to a line, used in sounding the depth of water. *Plummet-line*, a line with a plummet.

Plush. [Fr., from L. *pilus*, hair.] A kind of cloth with a nap or shag on one side, longer and softer than the nap of velvet.

Poin'ter. A breed of hunting dogs which, when they scent game, stop and stand motionless until

the hunter is near enough to shoot. Then, at the word, the dog darts forward and springs the game.

Poi'son. [Fr., from L. *potio*, a drink.] Any substance or matter which, when introduced into the body in any way, can destroy life by its own inherent qualities without acting mechanically. *Poison* usually denotes something received into the system by the mouth, breath, etc. *Venom* is something discharged from animals and received by means of a wound, as by the bite or sting of serpents, scorpions, etc.

Pole'cat. An animal of the Weasel tribe that is highly destructive to poultry. It possesses glands which secrete a fluid of a very offensive odor. This it gives off when pursued, thus checking dog or man until the animal can escape.



POTTERY

It occurs in all parts of Europe. The weasels generally emit a fetid secretion, much the worst examples being those of the polecat and the frightfully offensive skunk (*q. v.*).

Polo. A game of ball resembling hockey, the players being on horseback. It is of Eastern origin, and the name properly signifies the ball used in the game.

Pomade' or Poma'tum. [Fr., from L. *pomum*, an apple; pomade being formerly made by boiling apples in fat.] Ointment made of some fine inodorous fat, such as lard or suet, and used instead of liquid oil for dressing the hair. It is perfumed by the addition of fragrant essences or essential oils.

Pomegran'ate. [Fr., from L. *pomum*; and *granatus*, grained, having many grains or seeds.] A tropical shrub or small tree and its fruit, which is red, as large as an orange, and has a thick, leathery skin containing a juicy, pleasant-flavored pulp and numerous seeds. The pulp and the seeds are the parts eaten. The rind of the fruit and the bark of the root are used for tanning the finest morocco leather, and also in medicine.

Pop'lar. [Fr., from L. *populus*, a poplar.] A tall tree of the same family as the willow, of rapid growth, and having soft wood, capable of many uses. About twenty species are known, growing chiefly in mild and cold climates. The most important are the gray poplar, a native of Britain; the Lombardy poplar, of a conical form and without horizontal branches; the balsam poplar, the buds of which are covered with a sticky varnish called balsam; the Canadian poplar, and the cottonwood, a valuable timber tree, which is very abundant on the upper sections of the Mississippi and the Missouri valleys.

Pop'py. [AS. *popig*.] A herbaceous plant belonging to the genus *Papaver*, and bearing large, showy, but short-lived flowers. The most important species is that known as the opium or oil-poppy. It is extensively cultivated in warm climates for its milky juice, which when condensed forms the opium of commerce, and also for the bland fixed oil obtained from the seeds. *Poppy oil* is as sweet as olive oil, and is employed for culinary purposes. (See *Opium*.)

Por'celain. [Fr., from Ital. *porcellana*, the porcelain or Venus shell: L. *porcus*, a pig.] A fine kind of earthenware, first made in China and Japan; so called from its likeness in color to the Venus shell,

which was thought to resemble in shape the back of a young pig. It is now made in Europe and America. It is also called *china* or *chinaware*. Some of the French and English porcelain, especially that made at Sèvres and Worcester, is extremely white and translucent, but is more apt to crack by sudden changes of temperature, and is more brittle, than the finest porcelains of China and Japan. (See *Pottery*.)

Por'cupine. [Fr., from L. *porcus*, a hog; and *spina*, a thorn.] A nocturnal rodent quadruped, about two feet long, having on the head and neck a crest of long hairs, very short hair on the legs and muzzle, and the other parts covered with spines or quills, some a foot long, which, when excited, the animal raises almost at right angles with the body. Porcupines generally inhabit warm or tropical regions. The common or crested of southern Europe and northern Africa, and the Canadian or North American, are the best-known species.

Por'phyry. [Fr., from Gk. *porphyrites*: *porphyra*, purple.] A hard, finely-grained stone or rock, having a compact felspathic base, through which are scattered distinct crystals of one or more

minerals. Porphyry may be green, with blotches of paler green or white; or red, with white blotches or specks; and has other shades of color. The blotches of a polished surface are the felspar crystals.

The rock abounds in Egypt, in the northern parts of Europe, in South America, and in Mexico. All the varieties are esteemed as marbles, and used in fine sculpture-work.

Por'poise.

[Fr., from L. *porcus*, a hog; and *piscis*, fish.]

This animal belongs to the same genus as whales, and is the smallest and most familiar of the cetacean mammalia. It is from 4 to 6 feet in length, of a dusky or blackish color on the

back, and white beneath. It is closely allied to the dolphins, but has a shorter snout. When swimming, its round back looks like a hog in water. Porpoises swim in shoals, and drive herrings, mackerel, and salmon before them. They seek for prey near the surface, but also descend to the bottom in search of sand-eels and sea-worms, which they root out of the sand with their noses, as hogs do in the field for their food. From their blubber or flesh a fine oil is made, and from their skins leather for the uppers of boots and shoes.



THE POPPY PLANT.

back, and white beneath. It is closely allied to the dolphins, but has a shorter snout. When swimming, its round back looks like a hog in water. Porpoises swim in shoals, and drive herrings, mackerel, and salmon before them. They seek for prey near the surface, but also descend to the bottom in search of sand-eels and sea-worms, which they root out of the sand with their noses, as hogs do in the field for their food. From their blubber or flesh a fine oil is made, and from their skins leather for the uppers of boots and shoes.

Pot'ash. [Pot, and ashes, prepared by evaporating in iron pots the lixivium of the ashes of wood.] An alkali much used in the arts. It is an oxide of potassium, though the potash of commerce, usually called crude potash, is properly potassium carbonate, because it contains carbon as well as potassium and oxygen.

Potas'sium. A metal of a bright silver-white color, derived in 1807 by Sir Humphrey Davy from potash. It is prepared by heating together potash and carbon to a high temperature in an iron retort. It is lighter than water, brittle at 32° Fahrenheit, malleable at a little higher temperature, melts at 62°, and when heated to a temperature below red heat it yields a fine green-colored vapor. It has a strong affinity for oxygen, taking fire when thrown upon water or ice, and oxidizes so readily that to be preserved it must be kept in substances which contain no oxygen, as naphtha or kerosene. Its compounds are very important, being used in glass and soap making, in artificial manures, and in many drugs

and chemicals. The most important of the salts of potassium are potash, nitre or saltpetre, chlorate of potash, and cream of tartar.

Pota'to. [Span. *patata*, potato, from the native American word (probably *batata*) in Hayti.] Next to the cereals or grains, the potato is the most valuable of all plants used for food. It is a native of South America, and was introduced into Great Britain by Sir Walter Raleigh in the sixteenth century. The potato plant has a portion of its stem underground, and this part sends out roots and real branches. It is at the ends of these branches that potatoes are formed. Every part of the potato plant except the tuber dies off on the approach of winter, and the tuber is the special provision made by the plant for reproduction. The eyes of the potato are real buds, and the solid flesh of the tuber consists mainly of starch, the destined food of the young plant. Potatoes are largely cultivated in all mild climates. There are very many varieties, differing in time of ripening, form, size, color, and quality. New varieties are raised from the seed, but potatoes are grown by planting the tubers or cuttings of them, care being taken to have at least one eye in each piece. About three-fourths of the weight of a full-grown potato is water, and of the other fourth about one-sixth is gluten and five-sixths starch.

Pot'tery. [Fr. *poterie*.] The term applied to all objects made out of baked clay. The art of forming utensils of clay is of very ancient origin, extending back to the early days of mankind. Its rudimentary condition, that of merely molding soft clay into the desired form and drying it by the heat of the sun, was succeeded by baking it in a fire to make it harder and less brittle. Other substances were afterwards mixed with the clay so as to make finer and more delicate pottery. Gradually the potter enhanced the value of the art by forming graceful designs, and by painting and decorating them, until at the present day the art of the potter is one of the most important. Pottery may be divided as regards material and baking into three kinds—earthenware, stoneware, and porcelain or china. The term *pottery* is applied to all ware of the opaque kind, while *porcelain* applies to that which is translucent.

Prai'rie. [Fr., from Low L. *prataria*; L. *pratum*, a meadow.] A large level tract of country, bare of trees, covered with coarse grass, and generally of a fertile soil. This name is applied to the treeless plains of the Mississippi valley. Similar plains in the South are called Savannas.

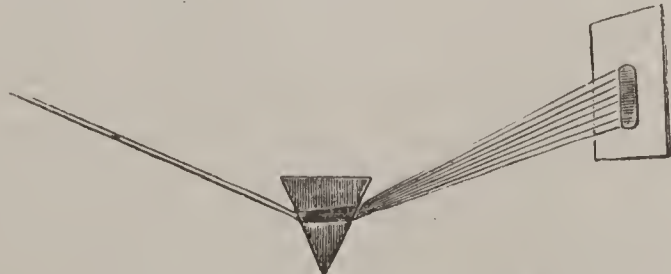
Prai'rie-dog. A small rodent animal, allied to the marmot, and found in the prairies west of the Mississippi. It is gregarious in habit, dwells in largely arid districts, makes deep burrows in the earth, and throws up mounds. On these the animal often sits, and, if disturbed, gives a warning cry somewhat like the bark of a small dog.

Precious stones. Minerals which are used in jewelry on account of their rarity and beauty. They include the diamond, ruby, emerald, sapphire, and many others.

Prim'rose. [Old Fr. *primerole*, from L. *primula*; corrupted in spelling as if from L. *prima rosa*.] A beautiful early-flowering plant, closely allied to the cowslip, common in meadows and on the banks of streams of England. The *evening prim-rose* is a biennial herb from 3 to 6 feet high, resplendent with yellow flowers which open at sundown, common in upland meadows, along fence-rows, and in sunny wastes.

Print'ing. The art of producing impressions on paper. It is divided into the printing of books and newspapers from movable type, and from stereotype or electrotpe plates. Printing was known to the Chinese as early as the sixth century, but their system was that of printing from engraved blocks. The invention of movable types is claimed by the Dutch in favor of Coster, 1420; and by the Germans on behalf of Gutenberg, 1440. Printing was introduced into England by Caxton in 1477. Wooden types were first used, but those made of type metal are now general. The first apparatus used for taking the impressions from types and blocks was in the form of a screw-press. This rude contrivance was soon replaced by a wooden lever-press, which in turn gave way to the hand-press made of iron, and this to the steam-press. Books are printed either on single-cylinder machines, which print one side of a sheet of paper by passing it over a form of type or plates, or on double-cylinder or perfecting machines, which print both sides of the sheet while it passes through the machine. In both cases ink (*q. v.*) is supplied by a self-inking apparatus, consisting of slabs and several soft composition rollers. Newspapers and periodicals are printed on rotary or web-printing machines, which take an impression from curved stereotype plates fixed on a rotating cylinder, the paper being run into the machine from huge reels. These machines produce from 12,000 to 24,000 printed sheets per hour. The Walter press, the Victory, the Hoe, and the Marinoni are most in use, and usually have folding-machines attached, which deliver the sheets folded. For some periodicals, not only the body of the magazine but the cover is printed on the same machine, and the magazine folded and inserted inside the cover.

Prism. [Gk. *prisma*, something sawn off; *prizein* = *priein*, to saw.] A piece of wood,



REFRACTION, THROUGH A PRISM.

metal, glass, etc., the ends of which are parallel, and equal in size and shape, and the sides parallelograms. Prisms of different forms are often named from the figure of their bases, as triangular, hexagonal, etc.—In optics, a three-sided piece of glass with two equal and parallel

triangular ends, used for separating the colors in a ray of light, and in refraction, etc. (See *Spectrum*.)

Pri'vet. [From *primet*, perhaps from *prim*, because cut and trimmed.] An ornamental European shrub, much used in hedges. (*Ligustrum*.)

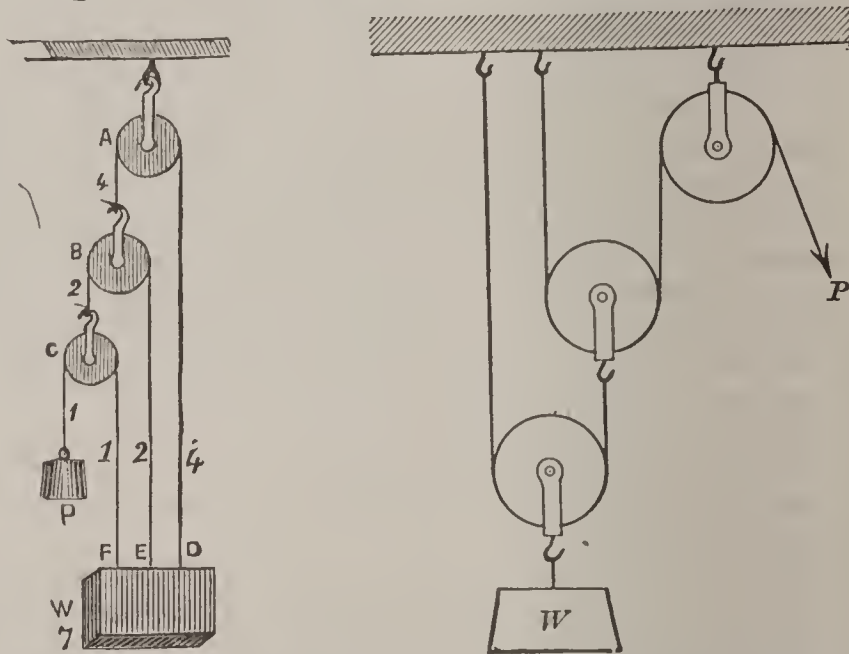
Propel'ler. A contrivance for propelling a steamship, usually consisting of a screw placed in the stern, and made to revolve under the water by an engine.

Prune. [Fr., from L. *prunum*, a plum.] A dried plum, much used in cookery. The best prunes come from France, where several kinds of plums are raised for making prunes. Great quantities are also exported from Bosnia and Servia.

Ptar'migan. The white grouse, a bird found in northern Europe and America. Its color in summer is a pale-brown or ash, with wings and under-plumage white. In winter its plumage changes in color to a pure white.

Puf'fin. An arctic sea-bird allied to the auks, so called from its short, thick, swollen beak and rounded belly. It is also known by the names of *bottle-nose*, *cockandy*, *coulterneb*, *mormon*, *pope*, and *sea-parrot*.

Pul'ley. [Fr., from *pull*, or from Low L. *pullanus*, a colt.] One of the mechanical powers, consisting of a wheel called the *sheave*, movable about



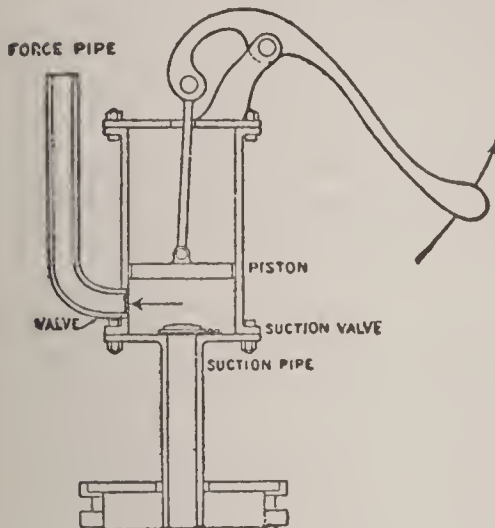
an axis, and having a groove cut in its circumference, over which a cord or rope passes. The rope is attached at one end to a fixed point, and the force acting on the free end of the rope is doubled, but the load is only moved through half the space traversed by the rope. Pulleys are used either singly to change the direction of the power applied, or in various forms of combination to raise heavy weights.

Puma. (See *Cougar*.)

Pum'ice. A porous mineral thrown out from volcanoes. It is a spongy lava, so light that it will float on water. It is powdered and used as a polishing material.

Pump. A hydraulic machine, variously constructed, for raising water and other liquids. The common or suction pump is constructed as follows:—The lower end of a long, narrow, vertical pipe, called the *suction-pipe*, is immersed in a

well or reservoir of water, and the upper end communicates with a wider pipe, called the *barrel*, which has a lid on the top and a spout on one side near the top.



The barrel contains two valves, both opening upwards,—the lower one, between the suction-pipe and the barrel, called the *suction-valve*; and the upper one, called the *piston valve*, affixed to the upper surface of a movable piston, connected by a rod with the handle of the pump. On work-

ing the pump the air below the piston is exhausted, and water is forced into the vacuum and through the lower valve by atmospheric pressure. On the descent of the piston the water above the lower valve, closing that valve by its weight, passes through the piston, and is then lifted to the level of the discharging tube or spout. (See *Air-pump* and *Force-pump*.)

Pump'kin. The fruit of a plant allied to the squash, and belonging to the gourd family. The plant is a running vine, the fruit a large oblong globe, of orange color when ripe, and sometimes of immense size. It is used for feeding cattle, and as a food; either boiled, or made into a pie with other ingredients.

Purse. [Fr., from Low L. *bursa*, a purse: Gk. *byrsa*, a hide.] A small bag for money, generally

made of skin or leather; a small bag or pouch, the opening of which is made to draw together closely.

Put'ty. [Fr., from *polce*, from *pot*, pot; what was formerly called *putty* being a substance resembling what is now called *putty powder*, and in part made of the metal of old pots.] A mixture of whiting or soft carbonate of lime and linseed oil, beaten to the consistence of dough, and used in fastening glass in sashes, and for filling up crevices, etc. *Putty powder* is an oxide of tin, or of tin and lead in various proportions, used in polishing glass, metals, and precious stones.

Pyr'amid. A solid body whose base is a square, triangle, or polygon, and its sides plane triangles, meeting at top in one common point. Architecturally, it applies to the great mounds of stone or brickwork found in Egypt, and in some other countries. The largest of the pyramids is that built by Cheops, on the plain of the Nile. This has a square base, each side of which measures 763.4 feet, while its height is 480 feet. The pyramids contain sepulchral chambers, in which the bodies of the Pharaohs were buried.

Pyrometer. [Gk. *pyr*, fire; and *metron*, a measure.] An instrument for measuring heat too high in temperature to be measured by common thermometers, as the heat of furnaces.

Pyx. [Gk. *pyxis*, a box; *pyzos*, box-wood.] The sacred box in the Roman Catholic Church in which the host is preserved; the box at the Mint which holds the sample coins that have been tested for the weight and fineness of the metal; the box in which the compass is suspended.



Quad'rant. [L. *quadrans*, a fourth part.] An instrument used in astronomy, navigation, surveying, and gunnery, for measuring altitudes and determining angular measurements. It generally consists of a brass limb, the quarter of the circumference of a circle, mounted on a frame and marked with degrees, minutes, etc., and having a plumb-line or spirit-level for fixing the vertical or horizontal direction.

Quag'ga. An animal of the Horse tribe, found in southern Africa. It strongly resembles the zebra, though of smaller size. It is social in habit, lives in large troops, and is more easily tamed than the zebra. It is said to have been largely or wholly exterminated by hunters.

Quail. [Fr., from Low L. *quaquila*; from Old Du. root of *quack*, because of its cry.] A bird of passage, the smallest of the Partridge family, common in the south of Europe, and in Asia, Africa and North America. Quails live in flocks, feed chiefly on insects, slugs, grains, and seeds, and are noted for taking long and fatiguing journeys. Immense flocks visit the countries along the Mediterranean, and large numbers are caught for food. The flesh is more juicy and delicate than that of the partridge.

Quar'antine. [Fr. *quarante*, forty; L. *quadraginta*.] The space of time, formerly forty days, but now variable in length, during which a ship suspected of having infectious disease on board is obliged to forbear all intercourse with the shore.

Quart. [L. *quartus*, fourth.] A measure of capacity, in dry and in liquid measure, equal to two pints, or the fourth part of a gallon. The English quart contains 69.32 cubic inches; the United States dry quart contains 67.20 cubic inches, the fluid quart 57.75.

Quartz. [Ger. *quarz*.] The common name of silicon oxide or silica, the most abundant of all minerals, being one of the constituents of granite, gneiss, mica slate, etc. It forms quartz rock and sandstone, and makes most of the sand of the seashore. It occurs massive, crystallized, granular, and in other forms. The primary form of the crystal is a rhomboid; but it is generally met with in hexagonal prisms, terminated by hexagonal pyramids. When crystallized and pure, it is called *rock-crystal*, and is transparent and colorless. Quartz is so hard that it will scratch glass and strike fire against steel. It comprises numerous varieties, many of which

are colored by different substances—as purple quartz, or amethyst, rose quartz, yellow quartz, chalcedony, agate, carnelian, bloodstone, jasper,



THE QUAIL.

sard, onyx, cat's-eye, etc. Quartz is used in the manufacture of glass, and of porcelain and other kinds of pottery; also as a flux in the smelting of several kinds of ores. Gold often occurs in quartz veins, and quartz-crushing machines are used to extract the gold ore.

Quas'sia. [Named from a negro, *Quassy*, who first made known the medicinal virtues of one of the species.] A genus of tree belonging to the tropical parts of South America. The wood of the root is intensely bitter, and is used in medicine, and sometimes as a substitute for hops in making beer.

Quay. [Fr. *quai*.] A bank or wharf constructed toward the sea or at the side of a harbor, river, or other navigable water, for convenience in loading and unloading vessels.

Quicklime. A white, caustic, infusible powder, obtained in a state of purity by heating pure carbonate of lime to full redness; so called because when wet it develops great heat. The quicklime of commerce is obtained by calcining in kilns any carbonate of lime, as limestone, marble, chalk, etc. Mixed with sand and water it forms lime. (See *Lime*.)

Quicksilver. [*Quick* and *silver*.] Mercury; so named for the great mobility of its globules, and its resemblance in color to silver. (See *Mercury*.)

Quilt. [L. *culcita*, a bed, a cushion.] A cover or coverlet made by stitching one cloth over another, with some soft substance, such as wool, cotton, etc., between them.

Quince. [Fr. *coing*, from L. *cydonius*, a quince tree; so called from the town of Cydonia, in Crete, which was noted for its quinces.] The fruit of a shrub which grows in mild climates, and belongs to the same family as the apple. The fruit is usually pear-shaped, but some quinces look more like an apple. Quinces possess a hard flesh of high flavor, but very acid, and though not good to eat raw, they are largely used for marmalade, jelly, and preserves.

Quinine. [Fr.] An alkaloid obtained from the bark of different species of cinchona trees, originally known in Peru, but now transplanted to Java and India. It has a bitter taste, and forms the base of certain salts used in medicine. —*Sulphate of Quinine*, a salt crystallizing in snow-white, light, efflorescent needles. It is not very soluble in water, but dissolves easily when a drop or two of sulphuric acid is added, and is extensively used in medicine as a tonic and febrifuge.

Quire. [Fr. *cahier*, a book of loose sheets.] Twenty-four sheets of paper of the same size and quality, unfolded or having a single fold; one-twentieth part of a ream.

R

Rabbit. A small rodent quadruped of the Hare family, living chiefly in large colonies called warrens, in burrows dug deep into the ground. They are not much seen during the day, but come out at night to eat, and they often do great damage by gnawing the bark off young trees and by spoiling growing crops. Rabbits are remarkably prolific, and have become pests in some parts of Australia and New Zealand. The common European species, which is often kept as a pet, has been introduced into many countries.

Raccoon. [Fr. *raton*, a little rat.] A carnivorous animal of the Bear family inhabiting North America. Its body is gray, varied with black and white. The average length of the raccoon is about two feet from the nose to the tail, and the tail is about ten inches long. The head somewhat resembles that of the fox. It feeds chiefly by night, keeping in its hole during the day, except in dull weather. One of the marked

peculiarities of the common species, *Procyon lotor*, and on which its specific name (*lotor*, from L. *lavare*, to wash) is founded, is its habit of plunging its dry food into water before eating it. Its fur is valuable, particularly in the manufacture of hats.

Radish. [Fr., from L. *radix*, a root.] A garden plant, cultivated for its pungent fleshy root, which is eaten raw for salad.

Raft. [Scand.] A float consisting of logs, boards, or other pieces of timber fastened together, either to serve as a support in conveying other things, or for their own collective conveyance on the water.

Rail. [Fr. *râler*, to rattle in the throat.] Numerous species of birds prized as game birds. The common European *land-rail* is usually known as the corncrake. It has a grating cry, familiar in summer. The *water-rail* has a longer bill and darker plumage, and loves the

wet marshes. It is found in Iceland, North Africa, and China. American species are the clapper-rail or marsh-hen, the king or red-breasted rail, the Virginia rail, and the Carolina rail or ortolan. The flesh of all these birds is delicate, and the Virginia rail is a favorite game bird.

Rail'way or Rail'road. A road or way of parallel iron or steel rails on which the wheels of carriages run, and supported on a bed or structure. *Railway* is the usual word in England, but *railroad* is common in the United States. The modern railroad is an adaptation of the old horse tram-roads, with cast-iron flange rails, used for hauling coals early in the century. The Stockton and Darlington Railway, the first line with locomotives, was opened in October, 1825. The first passenger line in the United States was the Baltimore and Ohio, opened in 1830. There are now over 190,000 miles of railroad in the United States, 160,000 in Europe, and about 450,000 in the world. Rails are now usually laid to the standard width or gauge of 4 feet 8½ inches. The iron rail, formerly wholly in use, has been widely replaced by steel. The steam locomotive known as the *Rocket*, invented by Robert Stephenson in 1829, weighed 8 or 9 tons; locomotive engines now weigh from 35 to 50 tons, and draw a train averaging from 400 to 500 tons. In 1838, on the London and Birmingham line, a speed of 20 miles an hour was obtained. Now a speed of 50 miles an hour, including stoppages, is maintained on one of the New York Central trains between New York and Chicago for a distance of nearly 1,000 miles, and 60 miles an hour is made on some roads for shorter distances. A straight and horizontal surface being the standard of perfection for railroad-making, sharp curves and steep gradients are regarded as evils. Routes are therefore shortened by embankments, cuttings, tunnels, and bridges. Among the remarkable railway tunnels are the St. Gothard and Mont Cenis in Switzerland, and the Hoosac Tunnel in Massachusetts. Of railway bridges the most wonderful are the Forth Bridge, Victoria Bridge (Montreal), Britannia (Menai Strait); also those at St. Louis, Rock Island, Louisville, and Niagara. Cars such as Pullman cars, with entrance at each end, are common in the United States and Switzerland; those entering at the sides are usual in Britain and other parts of Europe.

Rain. [AS. *regen*.] Water falling from the clouds in drops. This is the chief source of water-supply. By the heat of the sun water is evaporated from the surfaces of the seas and oceans and transported as water-vapor by winds. When it is condensed by cold, chiefly caused by the heated air rising into higher regions, it returns again to the liquid state, and falls down as drops of water in rain; or, if the cold be very great, the water may pass at once into the solid state, and fall as snow or as hail. *Rain-water* is very soft, and in country places it is pure; the air of large towns being full of impurities, the rain brings

them down with it as it falls, and so purifies the air by washing it. In Britain the prevailing winds are westerly, and, being charged with moisture from the Atlantic, much rain falls on the western coasts, and pasture is abundant. In the eastern part of the United States, where there are no great mountains to catch the moisture, the rainfall is uniform; but in the west and north the rainfall is determined by a centre of low atmospheric pressure in the Rocky Mountains. The heaviest rains occur in the tropics, and are confined to one part of the year called the *rainy season*. At a point 100 miles north of Calcutta the annual rainfall is from 500 to 600 inches. In Burmah the rainfall is 200 inches.

Rain'bow. [AS.] A bow or arch in the sky opposite to the sun in time of rain, caused by the rays of light breaking up into their seven separate colors as they fall on the rain-drops. (See *Prism*, *Spectrum*, *Light*.) Rainbows sometimes occur on the spray rising from waterfalls. Most rainbows are seen in the afternoon, when the sun is in the west, and sometimes in the morning, but never at noon, because then the sun is above us, and we cannot stand between it and the rain. When there is a double rainbow the inner is the primary, and the outer the faint or secondary one.

Rai'sin. [Fr., from L. *racemus*.] A ripe grape dried in the sun or by artificial heat. (See *Grape*.) Raisins are dried either with the stalk cut nearly into two and left to dry on the vines, or with the branch wholly cut off, hung up, or laid on floors to dry. The first are best, and are called the muscatels or raisins of the sun, and the finest come from Malaga and Valencia in Spain. Sultanias are made from a grape without seeds, and are brought from Smyrna.

Ram'ie. The fibres from the bark of the ramie plant, a native of India, now grown in the United States. The fibre is strong and lustrous, but the difficulty of separating it from the bark has proved a check to its use. The plant is a tall herb, sending up long shoots after each cutting.

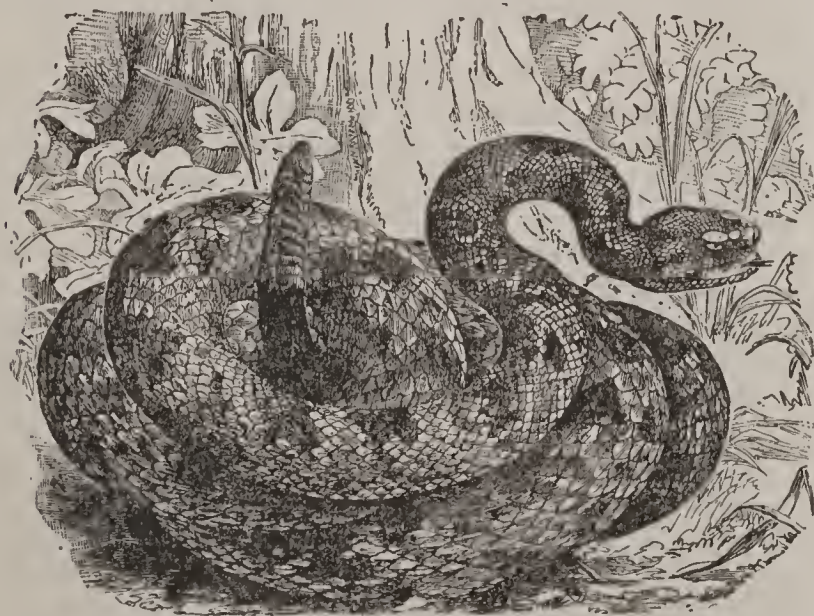
Rape. [L. *rapa*.] A root plant with a leaf like that of a swede turnip and a stem resembling that of a cabbage. It is sown in rows and hoed out like turnips. The plant grows rapidly, and its roots penetrate deeply into peaty soils and clays. The seeds are useful for cage-birds, and from rape-seed rape-oil is produced.

Rasp'berry. A kind of shrub with a thimble-shaped fruit, dark-red, large grained, and covered with a thick bloom. Like the strawberry it belongs to the Rose family; but, unlike the blackberry of the same family, the rasp separates readily from the core or receptacle. It has a perennial root, producing biennial woody stems or canes reaching to from 3 to 6 feet in height. Usually the canes do not bear till the second year, and that ends their life, their place being taken by a new growth from the root. The wild raspberry is called the bramble. Raspberries are used for jams, jellies, and wine beverages.

Rat. [AS. *ræt.*] A gnawing or rodent animal like the mouse, but larger and more destructive. It has sharp chisel-shaped teeth, with which it gnaws holes through wood-work, and with its claws it burrows under floors. It can climb trees, and descend headforemost by means of its claws, which are hooked, and turn inward or outward. Rats are not easily caught, because they are so cunning and have so keen a scent that they will not go near a trap set by a person with bare hands. They eat both animal and vegetable food, and are found in fields, in woods, in the water, in houses, in barns, and in sewers. They cross the sea in ships, and have followed man over the world. They are a pest to the farmer, and destroy grain, steal eggs, and kill young poultry of the farm-yard. The rat increases in swarms, often alarmingly. But the cat, the dog, the ferret, the weasel, the hawk, and the owl all prey upon rats and keep down their numbers. They are fierce and dangerous and bite viciously. The common brown rat, or Norway rat, is about 10 inches long, and has a tail of about 8 inches, a pointed nose, and whiskers like a cat. Its fur is light brown above and dirty white beneath, and its feet are flesh-colored. The black rat is smaller and weaker. Water-rats are almost as large as brown rats, but are harmless, feeding on vegetable food, and making their holes in the banks of rivers, ditches, and ponds. Gloves are often made of rat-skin, and the fur is used for covering hats. In China the flesh of the rat is regarded as a delicacy. The squirrel-tailed wood-rat of the Rocky Mountains builds a great nest of sticks and brush in a tree or clump of shrubs.

Rat'chet=wheel. A toothed circular wheel acted on by a bar or catch. The wheel moves forward by a reciprocating lever, and cannot be reversed until a ratchet or click for preventing backward motion is removed or lifted.

Rattan'. The long, slender stem of a species of



RATTLESNAKE.

calamus and other allied species of palms, which are among the most useful plants of Malaysia. These stems are largely used for cane-work, and also for making walking-sticks.

Rat'tlesnake. [O.E.] A poisonous snake of America, with horny interlocking joints at the end of its tail with which it makes a rattling sound before striking its prey. The rattle is composed of a number of horny, button-like rings which fit loosely into one another and make a rustling noise when shaken rapidly. Some think that one new rattle is added with each shedding of its skin. The poisonous fangs take the place of other teeth in the upper jaw. These fangs are a pair of large teeth punctured by a tube from the poison-gland. They are laid back when not in use, but when the snake strikes its prey the fangs spring forward and the poison flows from the poison-gland. Its bite is very poisonous, and it is very much dreaded. The best known are the diamond rattlesnake of South America and the common rattlesnake of North America. (See *Fang*.)

Ra'ven. [AS. *hræfen.*] (*Corvus corax*.) A bird like the crow, but larger, with a croaking voice and thievish habits as regards trinkets and food. It was once plentiful in England, but is now rare. Its color, though apparently black, is a deep blue. Its wings are long and slightly rounded, and its flight steady and rapid. It has a sedate walk, and when carrying off food has a curious hop, and makes use of its wings at the same time. It is wary, but is easily tamed and very sagacious. The raven is found in most parts of the globe, and ranges as far north as Melville Island, it being one of the few birds that brave the cold of an Arctic winter.

Ray. [Fr.] A flat kind of fish with ray-like fins on its breast. It has eyes on the upper surface, which is the back of the animal, and not the side, as in ordinary flat-fishes. The mouth is large, and the jaws are covered with numerous rows of small pointed teeth. The skin is usually beset with spines, in many cases resembling true teeth in structure, and sometimes quite formidable weapons. Its eggs are enclosed in brown leathery four-sided cases like those of the shark or dog-fish, and with long processes at the angles. True rays have the snout more or less pointed, the tail slender, and two small dorsal fins. The Ray family includes the skate and thornback. Sting rays have long, tooth-like spines, which are often used by savages to form barbed spear and arrow heads. The sting ray is common in the Mediterranean. Eagle rays, or white rays, have great pectoral fins, which resemble wings, and their tails are like whips. Sharp-nosed rays are favorites of the French, who eat them instead of skate. Electric rays are sometimes called torpedo fishes.

Ra'zor=bill or Common Auk. A sea-bird allied to the great auk, which is now extinct. It has wings large in proportion to its size. It is 17 or 18 inches long, and its wing is 7 or 8 inches, and when extended the wings are 27 inches wide. It has a glossy black head, a dark-brown throat, a white breast, and lower body of white. Its bill is strong and hooked. It lays one large egg of a greenish color. This bird abounds in the Arctic seas, migrating southward in the cold season.

Ra'zor-fish. A long, slender, and brittle mollusc that abounds on all sandy shores. The shell has delicate tints of rose and violet, covered by a brown epidermis. By means of its muscular foot it digs a deep hole, which it does not leave, but raises itself to the entrance of the hole. It is timid and difficult to catch.

Ream. [Fr., from Arab, *rizmat*, bundle.] A quantity of paper, consisting of 20 quires or 480 sheets. A common practice now is to count 500 sheets to the ream.

Reau'mur. A thermometer with zero as the melting-point of ice, and 80° the boiling-point of water. Four degrees of Reaumur are equal to 5 degrees Centigrade and 9 degrees Fahrenheit. The Reaumur thermometer is in general use in Spain and Germany.

Reed. [AS.] A thick, coarse grass, with hollow, jointed stalks, growing in or near water. The common reed grows in Europe and North America. The bamboo is a useful reed. The papyrus is often called the *Egyptian reed*.—A slip of cane in the mouth-piece of a musical instrument, and set in vibration by the breath. In the harmonium, melodeon, and accordeon the reed is a thin piece of metal which by vibration produces the tones of the instrument.

Reef. [Du. *rif*, a rift.] A line of rocks lying at or near the surface of the water. Any large vein of auriferous quartz or rock yielding ore is called a reef.

Reflec'tion. The effect produced upon light by a smooth surface. Part of the light enters the body, part is thrown back or reflected at an angle opposite to that made by the incident ray. This is the principle of the mirror, the body whose light is reflected seeming to lie behind the mirror, in the direction of the reflected ray.

Refrac'tion. When a ray of light passes from space through the air, or from air through water, glass, or other transparent, it is bent from its original course more towards the line leading to the earth's centre. This bending is known as refraction, and is the source of various important phenomena of optics.

Rein'deer. [Scand. from Lappish.] A kind of deer with branching horns found in the extreme north parts of Europe and America. Reindeer are gregarious and herd together. The full-grown bucks shed their horns. The horns of the female reindeer are retained during the winter. The reindeer feeds on the lichen that thickly carpets barren lands in the subarctic regions. The common European reindeer is domesticated in Lapland. Laplanders depend on it for its milk, and as a beast of burden, or to draw sledges over the snow. When the path is good and not too hilly, the reindeer can travel 100 miles a day. Their feet are well suited for walking on snow, owing to the manner in which the hoofs separate in treading, and to the long, coarse hair growing between the hoofs. The Siberian reindeer is larger than that of Lapland. The reindeer of North America are the cariboo or woodland reindeer, found in Canada and Maine, and the barren ground reindeer of the Rockies.

Rem'ora. A fish possessed of a structure which enables it to cling to foreign bodies. This is a modification of the dorsal fin, which becomes a flattened disk covering the top of the head, and acts as a sucker. Fables have arisen to the effect that this fish could arrest the course of a ship to which it attached itself. The species are from 12 to 20 inches long.

Rennet. [AS.] A preparation of the inner lining of the fourth stomach of a calf, used to curdle milk.

Reptile. [Fr., from L. *reperere*, to creep.] Reptiles form the first class of the higher vertebrata, or of those which never breathe by gills, like the amphibians. Their blood is cold, and they closely resemble birds in the development of their young; but their eggs are very large. Reptiles include alligators, turtles, snakes, and lizards. Formerly amphibians were classed with reptiles, and are still properly called reptiles, though more closely allied to the fishes. Reptiles, except tortoises, are long, often nearly cylindrical, and usually covered with scales, and have long tails. The feet are of different lengths, but seldom suffice to support the body, the belly trailing on the ground when the animal is in motion. The mouth is large and armed with sharp, hooked teeth; but in tortoises no teeth exist. The heart generally has two auricles and one ventricle. The ribs are always well developed; the limbs when present are well developed; the feet are freely movable, and end in strong claws. Except tortoises, all reptiles are carnivorous, feeding upon living prey; their teeth not being constructed for the division of flesh, they swallow their victims whole. Reptiles are essentially inhabitants of the warmer regions of the earth. In earlier geological periods, before the age of the mammalia, reptiles were often quadrupeds of immense size and strength. Some were essentially tripeds, supporting themselves on their hind legs and tails; and some gained the habit of flying, with the aid of membranous wings.

Res'in. [Fr., from L. *resina*.] A half liquid substance, that flows from trees. Resins are made up of carbon, hydrogen, and oxygen, and are probably the essential oils of the plants oxidized by the oxygen of the air. They dissolve in alcohol and ether and volatile oils, but not in water, like gums. Copal, lac, mastic, and benzoin are hard resins; turpentine and copaiba are soft resins. The common resin of commerce exudes from the pine tree, and is largely used in making varnishes and in several medicines.

Ret'ina. [L. *rete*, a net.] A fine net-like coating at the back of the eye, made up of the optic nerves which carry the sense of sight to the brain. The optic nerve and retinal blood-vessels spread out on the front of the retina, and the sensory layer, with rods and cones, is on the back part next the choroid coat.

Retort'. [L. *retortus*, twisted back.] A vessel with a long bent tube used by chemists in decomposing substances or in distilling. For distilling liquids a glass retort is employed. Metal retorts are used in distilling coal, wood, or bones.

Retriev'er. [Fr.] A dog trained to find and bring back game that has been shot or wounded.

Revolv'er. A pistol with several chambers revolving on an axis, that can be fired one after another by the same trigger through the same barrel.

Rhe'a. The American ostrich. This is scarcely



more than half the size of the African species, and differs from it in having the head feathered. It is gray in color, and has none of the beauty of the true ostrich. It is abundant in South America.

Rhe'ostat. A resistance box in the path of an electric current, for the purpose of increasing the general resistance to the current flow. The box contains coils of wire made of a metal that is a poor conductor of electricity. When the current is first turned on to a motor, as that of a streetcar, it is important that it should be done gradually, so that the motor will not start off at once with full force. This is accomplished by sending the current through a rheostat. If the box have 12 coils, the current is sent at first through the whole of them, then, by turning the handle, through 11, 10, 9, and so downward, until all the coils are cut out and the entire strength of the current reaches the motor, and sets it turning at full speed.

Rhinoc'eros. [Gk. *rhis*, *rhinos*, the nose; and *keras*, a horn.] A hoofed animal with a horn, and next in size to the elephant. Its horn is placed upon the skin behind the nostrils. It is not unlike whalebone, and is made of a number of fine hairs firmly glued and pressed together. The point of the tip is very smooth and quite sharp, but the lower part where it joins the skin is rough. It is very heavy, and is made into drinking-cups. The Indian or white rhinoceros and the Javan rhinoceros have one horn. Two or three African kinds have two horns, but no canine or incisor teeth. The lower horn stands straight out from the head, and is often 4 feet long. The rhinoceros is from 4 to 5 feet in height and 11 in length, and has such a thick, tough skin that nothing can pierce it, therefore the natives make it into shields. The rhinoceros

has a savage temper, and is a dangerous enemy. It lives alone in thick forests by the banks of rivers; for it is a great swimmer, and spends a great portion of its time in water, where it can easily find leaves and grasses for food. It has on each foot three toes, with a hoof on each toe.

Rhododen'dron. [Gk. *rhodon*, a rose; and *dendron*, a tree.] A kind of shrub of the Heath family, with evergreen leaves and large, showy flowers like roses. No other shrub equals it for beauty of form and foliage and profusion and variety of flowers. It is abundant in the mountain regions of the eastern United States, often forming impenetrable thickets in the northern Alleghanies. It is also common in India. Several species have been domesticated and a great variety of very handsome flowers produced by cultivation.

Rhu'barb. [L. *Rha*, Volga; *barbarus*, foreign.] A plant (*Rheum rhaponticum*) brought from the banks of the Volga, the stalks of which are used as food. The stalk is large and fleshy, and very juicy; the blade is broad, with large veins running from the foot-stalk. The stalk and veins are smooth, and covered with a fine thin skin easily removable when the leaf is young. It is used as a substitute for fruit in pies and tarts, and the juice is pressed into wine. Rhubarb of medicine is the dried root of a wild plant (*Rheum officinale*) now chiefly brought from China and Tibet.

Rib'bon or Rib'and. [Celt.] A long, narrow web of silk or other material used for trimming dresses. Ribbons are chiefly made at St. Etienne in France, Basle in Switzerland, Coventry in England, Crefeld in Prussia, and Paterson, New

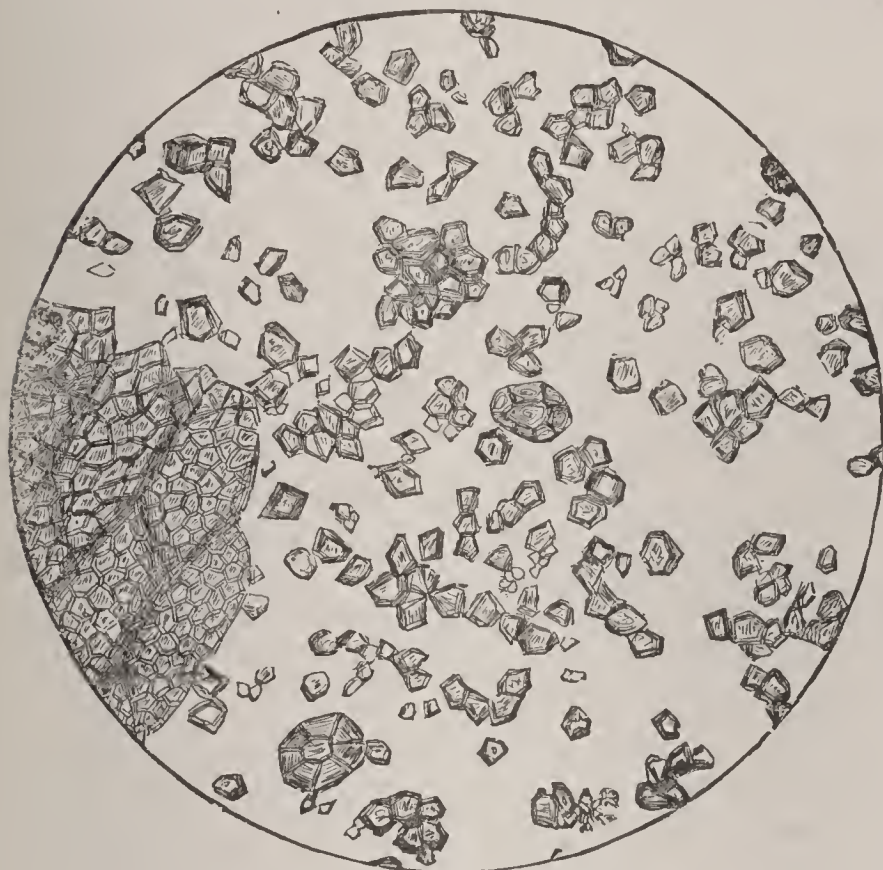


THE AGE OF REPTILES.

Jersey. French and Swiss ribbons are hand-made; English ribbons are machine-made. Italian and French silk is used in making the best ribbons.—*Ribbonfish* is a fish of the North Atlantic, 20 feet long.

Rice. [Fr., from Gk. *oryza*.] A grain grown in warm countries, and forming a food for three-fourths of the human race. Rice is a kind of grass, having a stalk with several stems, each of which

bears a cluster of grain. It requires a hot climate and abundance of water. The plant is a native of the East Indies, and is most largely grown for food in India and China, but it is grown also in the southern United States and in the south of Europe. Its habits of growth have been modified by cultivation, so that a variety is grown on uplands without irrigation. The lowland crops are grown with irrigation on lands where no other



RICE STARCH UNDER MICROSCOPE.

crop is possible. Rice flour is used for cakes, and rice water is used medicinally. Rice forms the chief food of the Chinese and the Hindus. It contains in 100 lbs. no less than 76 lbs. of starch, which is largely used in the laundry to stiffen linen, etc.

Ri'fle. [Dan., to make grooves in.] A gun, or small-arm, the inside of whose barrel is *rifled*, that is, has spiral grooves cut in it. The effect of the grooves is to send the balls swifter and straighter. The rifles now used are breech-loaders. Cannon are also rifled, with the effect of enormously increasing their range and powers of destruction.

Rin'derpest. A malignant contagious fever, which attacks cattle and other ruminants. It came originally from Asia, and has very often appeared in Russia, from which it made its way over Europe, probably as early as the 4th century. There have been various outbreaks of it, causing great destruction of cattle. From 1865 to 1870 it caused great mortality, 130,000 cattle dying in France alone in 1870. In 1896 a serious epidemic broke out in Africa, extending from Abyssinia to South Africa, and decimating the domestic herds, while destroying great numbers of wild animals, especially antelopes. No cure is known for this disease, and the only safety is to kill and bury all infected animals.

Riv'et. [Fr., from Scand., to fasten.] A pin or bolt of metal passed through two flat pieces of metal, wood, etc., and fastening them together by its being hammered flat at both ends.—*Butt riveting.* The ends or edges of plates form a butt joint, and are fastened together by being riveted to a narrow strip which covers the joint. *Lap-riveting.* The ends or edges of plates overlap, and are riveted together.—*Chain-riveting.* The rivets in two or more rows are set behind each other.

Roach. [AS.] A European fresh-water fish of the Carp family, to which the dace and chub belong, of silver-white color, with a greenish back. The scales of this fish and the bleak are said to be employed in the manufacture of artificial pearls. Gold-fish belong to a similar family.

Rob'in. [From *Robert*.] A name given to red-breasted birds of different countries belonging to the thrush family. The robin of the United States is a common and favorite bird, its song being among the sweetest of those heard in our groves and orchards. The robin-redbreast of Europe is a smaller bird, which seems to delight in the presence of man, often entering his dwelling. It sometimes takes up its abode in houses in cold weather, while it warbles its song when the sun shines or the fire burns brightly.

Rock'et. [Ital., from *rock*, a distaff.] A fire-work sent up through the air and used as a signal. The rocket is projected by the force of expanded gases liberated by the combustion of such ingredients as nitre, charcoal, and sulphur. Congreve rocket, invented by Sir William Congreve, is armed with shells or case-shot, or with a fiery composition.

Rock-oil. (See *Petroleum*.)

Roco'co. A florid style of ornamentation which was common in Europe in the latter part of the eighteenth century.

Ro'dent. [L. *rodens*, gnawing.] A gnawing mammal, as a mouse or rat. They are all small, but very prolific, so that no mammalia are so generally distributed. Their teeth are peculiar and of two kinds—incisors and molars. The enamel remaining, while the body of the tooth wears away, gives it a peculiar curved shape.

Roe. [Scand.] The spawn or eggs of fishes and amphibians, especially when enclosed in a membrane.

Roe. [AS.] The smallest kind of European deer. Its antlers are small, with three short branches. It remains faithful to one partner for life.

Roent'gen Ray. On December 4, 1895, Professor Roentgen, of Würzburg, Prussia, published a description of a remarkable new ray of light he had discovered, which he called the "X-ray." This light flows from a Crookes tube, which is a glass tube exhausted of air, and traversed by an electric current. From the interior glow in this tube there flows a ray differing from ordinary light, since it fails to pass through some transparent substances and readily penetrates many opaque substances. It passes easily through human flesh, and less easily through bone, so that the bones of the body may be photographed

as dark shadows. An important fact is that any foreign substance in the body, as a bullet, a needle, etc., is revealed by the ray, and its exact location fixed. This renders the Roentgen Ray of the greatest value in many surgical operations.

Rook. [AS.] A bird like the crow, but smaller, with the base of its beak bare of feathers and quite white, and with a harsh, croaking voice. It feeds on grubs and worms, but will pull up new



SIGNET RINGS.

grass and potatoes, pick turnips, and steal eggs. Rooks are sociable birds, and build their nests together and live as one family. They usually settle in a clump of high trees, which is called a *rookery*.

Ro'sary. A series of prayers marked by beads, consisting of fifteen decades, each containing ten *avemarias*, a *paternoster*, and a *gloria patri*.

Rose. [L. *rosa*.] A shrub, usually with prickly stems, and large, beautiful, and sweetly-smelling flowers. The varieties of roses are generally classed as damasks, banksia, noisette, perpetuals, French, Chinese, Scotch, celestial, and moss roses. All may be propagated by layers, some by budding or grafting, and many by separating the roots. The moss rose came from Holland, the cabbage rose from Caucasus, and the yellow rose from Persia. In France the cultivation of the rose is a science. The varieties are great; of the tea rose alone there are 122 kinds. The Cherokee rose is a native of China, which has run wild in the American States. The sweet brier has also escaped from cultivation, and is found in the hedgerows. The oldest rose-bush in the world is at Heldersheim, in Germany. The trunk is as large as a man's body; and in the year 1079 a framework was put up to support its branches. It is supposed to be over 1,000 years old.—*Otto of roses* is an oil distilled from petals or leaves of damask or musk roses. The best otto of roses is made from Cashmere roses in India.

Rose'mary. [L. *ros*, dew; and *marinus*, belonging to the sea.] A small shrub, with narrow grayish leaves, a fragrant smell, and bitter taste. It is an emblem of constancy. This shrub grows wild along the Mediterranean coast, and is found in Asia Minor and in China. An essential oil distilled from it is used in perfumery and medicine.

Rose'wood. A leguminous wood of a dark-red color streaked with black, with a faint smell like that of the rose. The finest rosewood comes from South America, especially from Brazil, but also from Jamaica, New South Wales, and the

East Indies. The best is costly, and is chiefly used as veneering for cabinet-work.

Ros'in. The hard amber-colored resin left after distilling the volatile oil of turpentine.

Ros'trum. [L. *rostrum*, a beak.] The platform in the Roman Forum from which orators spoke to the people; so called because it was near where the beaks of ships taken in war were fixed. Also now any platform for speaking from.

Row'an Tree. [Scand.] The mountain ash, related to the apple, with pinnate leaves and small white flowers, followed by little bright-red berries.

Rub'ble. [Old Fr.] Rough stones from the quarry, or stones broken or worn with water, used for coarse building.

Ru'bric. [L. *rubric*, red chalk.] A part written or printed in red to distinguish it from the rest on a page.

Ru'by. [Fr., from L. *rubeus*, red.] A precious stone of a blood-red color, ranking in hardness next to the diamond. It is a red crystallized variety of corundum. The finest are Oriental rubies brought from Burmah, and are more valuable than diamonds of the same size. They occur in crystalline limestone, and consist of pure alumina, with the color of pigeons' blood. The spinal ruby consists of alumina and magnesia, and is found in Ceylon and Siam, varying from deep red to rose red in color.

Rum. A kind of spirit made from the juice of the sugar-cane or molasses. It is largely made in the West Indies and New England. Jamaica rum is colored reddish brown with caramel. Rum is sometimes flavored with pine-apple.

Ru'minant. [L. *ruminatus*.] An animal that chews the cud. (See *Digestion*.) Ruminant animals include the camel, deer, antelope, goat, sheep, and cattle.

Rupee'. [Sans., silver.] An Indian silver coin worth 16 annas, the value of which varies with the price of silver.

Rush. [AS.] A plant of many varieties, with a



SANDALS.

round pointed stem and no leaves, which grows in moist ground. Before carpets came into use, the floors of houses were strewn with rushes, and the wicks of

candles were made from the pith of rushes. Chair-bottoms and baskets are sometimes woven of them.

Rust. [AS.] *Blight*, *mildew*, and *rust* are names given to diseases which attack the stems and leaves of cereals and other plants. They first appear as small discolored patches, and gradually spread over the entire plant. This

discoloration is due to the presence of germs or seeds of the rust fungus in the first stage of life. These germs or seeds, after several stages have been passed, settle upon the plants and live on their juices, thus doing much injury.—*Rust* is also the reddish-brown coating formed by oxidation on the surface of iron when exposed to a moist atmosphere.

Rye. [AS.] A kind of grain, and the hardiest of the cereals cultivated in the British Isles. It looks like wheat, but its ears are bearded like those of barley, but not quite so long. The grain

is brown, and coarser than wheat. It will grow on poor sandy soils, and is able to bear a severe climate. Rye is sown in autumn. The "black bread" eaten by the peasantry of Russia and North Germany, and the rye-cakes of Sweden, are made from the rye which is very extensively grown on the sandy plains of those countries. Much whiskey is made from rye in the United States, and it is used with barley for making gin in Holland. Rye-straw is tough, and is not good for cattle, but is used for hats, stuffing beds, or thatching.

S

Sa'ble. [Fr., from Russian.] A small flesh-eating animal akin to the weasel, found in Siberia and northern countries, and valued for its glossy fur, which consists of a soft under-wool overtopped with longer hair. In summer the fur is brownish, with gray spots on the head and neck; but in winter it is deep rich brown and almost black. Winter fur is most valued, and is worn by ladies and by officials on their robes. The tail is made into artists' pencils and brushes. The sable spends most of the day in trees, and hunts at night. Its food is chiefly hares and small game. This animal is now getting scarce in Siberia, where it used to be hunted by Russian exiles.

Sa'bre. [Fr., from Ger.] A sword with a broad heavy blade, thick at the back, and curved slightly toward the point, used by cavalry.

Sac'charin or **Sac'charine.** [Fr., from *L. saccharum*, sugar.] Saccharin is a product of coal-tar, and it is said to be three hundred times sweeter than sugar. It is a valuable therapeutic, and has been recently used in the preservation of fruits.

Sad'dle. [AS., from root of *sit*.] A seat generally made of leather, fastened on a horse's back. The frame of the saddle is usually of wood and iron, made to fit the horse's back, and is called the tree. In the common saddle the tree is raised a little in front to form the pommel, and behind is a ridge called the cantel, the seat and flaps being made of tanned pig-skin. The stirrups are fastened to the tree. When the saddle is put on the horse, the girths are passed under the horse, and buckled tightly to straps. *Side-saddles*, used by women, have only one stirrup, in which the left foot is placed; and on the pommel are two horns, between which the right knee is placed.

Safe. [Fr., from *L. salvus*, safe.] A strong room or box for keeping money and valuables safe from fire and thieves. Safes are double wrought-iron chests, with plaster of Paris and mica or alum to resist heat. Burglar-proof safes are usually fitted with locks (*q.v.*) difficult to pick.

Safe'ty=lamp. A lamp for giving light in mines, covered with wire-gauze, to prevent the light from setting fire to explosive gas; called also Davy lamp. (See *Lamp*.)

Safe'ty=valve. A valve in a steam engine arranged to permit the steam to escape when it exceeds a certain pressure. The valve is held in

place by a weight attached to the end of a lever, and so adjusted that a fixed pressure of steam will lift it, and open a passage for the steam.

Saf'fron. A yellow coloring matter, obtained from the stigma, or flower centre, of a species of crocus. It is costly on account of the labor of picking the small stigmas. It has a pleasant perfume, and is used to color and flavor confectionary, cheese, and butter. Saffron tea is sometimes given to canary birds when shedding their feathers.

Sage. [Fr., from *L. salus*.] A grayish-green herb much used in cookery and medicine; so called from its supposed healing powers. It has a sweet smell and a bitter taste. The scarlet sage and Mexican red and blue sage are cultivated in America for ornament.

Sa'go. [Malay.] The prepared pith of a tree called the sago-palm, which grows in China, Japan, and the East Indies. The tree is cut down when fourteen or fifteen years old, the trunk split open, and the pith scraped out and washed in water. It is then squeezed through a

sieve and dried, and is called pearl sago, and used for puddings. In 100 lbs. of sago there are 83 lbs. of starch. Much false sago is made in Germany from potato starch.

Sal'ad. [Fr., from Ital. *salata*, salted.] Raw herbs cut up and dressed with salt, vinegar, oil, etc., as a relish for food.



SALMON LEAPING.

Salaman'der. [Fr., from *L. or Gk.*] A kind of reptile with four feet, long body, and long tail, but without scales. It is related to the frog, and was once supposed to be able to live in fire.

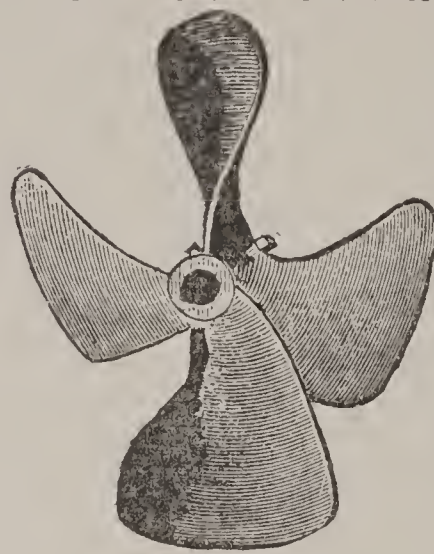
Sali'va. [L.] A liquid of an alkaline re-action which, secreted by the salivary glands from the blood, moistens the mouth and mixes with the food to help digestion. The salivary glands are excited to pour out saliva by the movement of the jaws in chewing and in talking. Touching any part of the mouth will cause saliva to flow. The sight, smell, or taste of food when one is hungry will "make the mouth water." When food is eaten hastily, and not moistened with saliva, the stomach is disarranged, and indigestion follows. Its action in digestion is due to the presence of ptyalin.

Salmon. [L. *salmo*.] A large fish much valued as food. Its color is bluish-gray, shading into a silvery-white underneath, and marked with black spots on the upper part of the body. Salmon are found on the European and American coasts of the Atlantic, passing up the rivers to deposit their eggs. On these journeys they pass waterfalls and other obstacles; but several British and Norwegian rivers contain salmon-leaps or fish-stairs, up which the salmon leap from step to step. After resting on the spawning-ground for eight or ten days, the females return to the sea. The eggs left in the gravel hatch out. The young fish increase little while in fresh water, but on reaching the sea they grow quickly. Salmon are now reared in farms or breeding-troughs, with fresh water flowing freely through them. A salmon usually weighs 10 or 12 pounds, but fish up to 30 or even 40 pounds have occasionally been caught. Salmon-trout and bull-trout are two kinds of salmon. *Parr* are salmon fry; *smelt* is a young salmon; *grilse*, a young salmon returned from the sea. The common salmon of Europe and the Atlantic is the *Salmo salar*. The salmon of the North Pacific belongs to a different genus, the *Oncorhynchus*; and the quinnat, the largest of these, does not feed in fresh water, and dies after spawning. They are caught in immense numbers in the rivers from California to Alaska, many millions of pounds being canned annually.

Salt. [AS.] A substance found in the earth, and very abundant in sea-water, used for seasoning and preserving food. It is composed of sodium combined with chlorine. Salt is important as an article of food, and the lower animals like it; farmers place lumps of rock-salt in their fields for the sheep and the cows to lick. In North America there are certain places where the rocks contain much salt, and wild animals flock in great numbers to these places, which are known as "salt-licks." Salt forms solid beds in the crust of the earth, just as coal does; and in this state it is known as *rock-salt*. Rain-water, sinking into the ground, dissolves much of the rock-salt; and if a well be dug down to this salt water, it can be pumped up, and the salt obtained from it by evaporation crystallizes in cube shapes. The salt water is called *brine*. Salt can also be obtained by evaporating sea-water. In the Carpathian Mountains there are beds of salt from 600 to 700 feet thick. Near Cracow there is a wonderful salt-mine over a thousand feet deep,

divided into floors, galleries, and passages, all of salt. One division is so like a church that it is called St. Anthony's Chapel. It has an altar, pulpit, and statues. Another room has a tomb made of salt. The passages are estimated to extend 300 miles. Rock-salt is abundant in many parts of the United States, and great quantities of brine are pumped up and evaporated in New York. Large deposits exist in Michigan, Louisiana, Utah, Nevada, and elsewhere.

Salt'petre, Nitre, or Rock-salt. [Salt; and Gk. *petra*, a rock.] A kind of white salt made up of nitric acid and potash, often found oozing from rocks. It is bitter in taste, and is called



SCREW PROPELLER.

potassium nitrate. It is found in caves or got from the soil in Egypt, Persia, and India. Its principal use is in making gunpowder and in preparing nitric acid, sulphuric acid, in making fireworks, and medicinally for rheumatism. *Chili saltpetre* is a sodium nitrate, which cannot be used in making gunpowder, but from which nitric acid is got.

Salts. Salts, in chemistry, are the neutral or

other compounds formed by the union of an acid and a base.

Sand. [AS.] Fine particles of stone on the sea-shore or in deserts, made by the wearing out of rocks, especially of quartz, silica, or flint. River-sand and sand from pits are usually sharper than sea-sand. The colors of sand are made by various oxides of iron. Sand is used in making glass, mortar, cement, sand-paper, molds for casting, and in sawing stones and grinding cutlery.—*Sand-blast* is a stream of sharp sand let fall from a high box on a plate of glass to cut it and make it look like ground glass. Metals and stones may also be cut by the sand-blast. The parts not requiring to be cut or engraved are covered with leather, paper, or wax.

San'dalwood. [Fr., from Sans., and *wood*.] A yellowish heart wood of trees in the East Indies and the Hawaiian and South Sea islands. It has a pleasant smell.

Sand'piper. A numerous family of game birds living on the sea-shore. The European kinds include the common sandpiper, called also summer-snipe, the dunlin, the knot, and the ruff. Some small plovers are called sandpipers. In North America are the pectoral, the purple, the red-breasted, and the spotted sandpipers.

Sand'stone. A rock of sand pressed together. Old and New Red Sandstone are two extensive series of British rocks, the one below and the other above the coal-measures. The terms Permian and Triassic have taken the place of the name New Red Sandstone. *Flexible sandstone* is a fine-grained variety of itacolumite, which, owing to scales of mica, is quite flexible.

Sand'wich. Two thin slices of bread with meat, cheese, or butter between them; first used by the Earl of Sandwich in the 18th century so that he need not leave the gaming-tables.

San'talin. A substitute for butter extracted from snet.

Sap. [AS., *saep*.] The fluid which flows through plants. The raw or crude sap consists of much water, with plant-food dissolved in it, entering through the roots. It rises through the outer part of the stem into the leaves, and is there converted into various non-nitrogenous substances, composed chiefly of carbon, hydrogen, and oxygen, such as starch, gum, sugar, cellulose, and oil. In the sap there are also formed substances containing nitrogen, such as albumen and gluten. These substances are distributed to every part of the plant, helping to form and to fill new cells, and so aiding the life of the plant.

Sap'phire. [Fr., from Gk., from Heb.] A precious stone of a bright-blue color, next in hardness to the diamond, and next to the ruby in value. It is composed of alumina, colored differently. The red sapphire is the Oriental ruby, the green sapphire is the emerald, the yellow the topaz, and the violet is the amethyst. Colorless or white sapphires are sold as diamonds. The finest blue sapphires come from Ceylon.

Sar'dine. [Fr., from L. *sardina*.] A small pilchard or herring found near the island of Sardinia, and preserved in oil for food. It has a slim body, and is greenish blue on the back and silvery-white below. It is also caught off the north-west coast of France and in the Baltic. American sardines are young herrings or menhaden. The sardines appear in large shoals in spring, and are caught in nets which are large enough to let their heads through, but catch them by the gills and fins. They are washed, scraped, salted, heads and gills cut off, washed again, and dried. They are then cooked in olive oil and dried again, and then packed in tin cases with boiling oil. Sprats, roach, and dace are sometimes put up in this way.

Sarsaparil'la. The dried roots of several American climbing evergreens, reaching from Mexico to South America. It is much used as a medicine. There is none of it in the sarsaparilla syrup drank in soda water.

Sas'safras. [Cor. from *saxifrage*, which now denotes a different kind of plants.] A kind of tree or plant, with aromatic properties, of the laurel kind, and allied to cinnamon, cassia, and camphor. Every part of the plant has a pleasant fragrance and a sweetish aromatic taste, which is strongest in the bark of the root. It occasionally grows to a height of 50 or 60 feet, and has a grayish and deeply-furrowed trunk. It is sometimes called the *ague-tree*. Its bark is used in dyeing, but also especially the bark of the root medicinally for rheumatism. The leaves are used in making root beer. The wood is tough, and does not decay.

Sat'in. [Fr., from L. *seta*, silk.] A kind of closely-woven silk cloth with a glossy surface. It is an elegant material. The woof, or cross-

wise threads, passes over several threads of the warp at a time. The fabric is then passed between heated iron rollers, which give a smooth, glossy appearance.

Sat'in-wood. A hard fragrant wood like yellow mahogany, from the East and West Indies. It takes a lustrous finish, and is used in cabinet-work.

Sat'urn. The planet next beyond Jupiter, and almost twice as distant, it being 875,000,000 miles from the sun. In size it comes next to Jupiter, its diameter being 73,000 miles. Its year is equal to nearly 29½ earthly years, and it rotates on its axis in 10 hours. In addition to its nine moons—one of them recently discovered—it has a remarkable feature in its two—or perhaps five—wonderful rings, which surround it at a distance of some 20,000 miles. These rings are supposed to be made up of meteors rotating in company around the planet.

Savan'nah. An extensive open grassy plain in the Southern States. (See *Prairie*.)

Sauer-kraut. A salted preparation of cabbage much esteemed in Germany, and largely used in the United States. It is thought to be very wholesome and easily digested, and is prepared in large quantities for winter use.

Savoy'. [Fr.] A kind of cabbage with curled leaves, originally from Savoy, much cultivated for winter use.

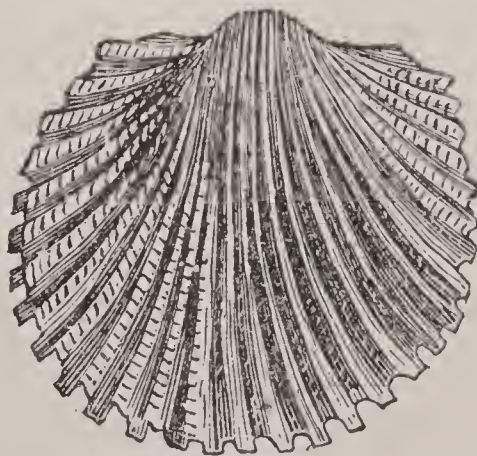
Saw. [AS. *saga*, from L. *secare*, to cut.] A thin steel blade with sharp teeth on its edge for cutting wood, etc. The chief kinds are the hand-saw, the cross-cutting saw, and the circular-saw, which is worked by machinery. The blades are of steel, the teeth being punched out by machinery, then ground and set and cleaned by emery. The *saw-gin* is the same as the cotton-gin, used in clearing the cotton fibre of its seeds.

Saxi'frage. [L. *saxum*, stone; and *frangere*, to break.] A kind of plant growing in the crevices of rocks or on high hills, once supposed to have the power of dissolving or breaking stone in the bladder. They are mostly perennial herbs.

Scale. [AS. *shell* or *husk*.] One of the thin plates covering the body of a fish or of a reptile.

Ganoid scales of fish like the gar and sturgeon are an inner layer of bone and an outer layer of shining enamel arranged to form a coat of mail. The Perch family have comb-like scales. Those of the herring and salmon are thin, with concentric lines of growth, and serrated on the margin, and are called cycloid scales.

Scale. [L. *scala*, a ladder.] A scale in music, is a series of tones from the keynote to the octave. A *chromatic scale* includes 8 tones and 5 half-tones. A *diatonic* or major or minor scale has eight sounds or tones.



SCALLOP.

Scal'lop. [Old Fr.] A shell-fish radially ribbed, and having the edges of its two-valved shell formed into a series of small curves. The shell is light, and the fish has a little air-bag which enables it to float. It abounds on the English and American coasts, and on the shores of Palestine. Formerly the shell was used to cook oysters in. An edible scallop is found on the Atlantic coast of the United States. The shell of the Palestine species was formerly worn by pilgrims to show that they had visited the Holy Land.

Scar'let = runner. A bean-plant with scarlet flowers which clings to and runs up any support it can reach.

Schoon'er. [AS., to glide.] A vessel with two or more masts, fore-and-aft rigged, or square-rigged on the fore-mast top-sail. The first schooner is said to have been built in Massachusetts in 1713.

Scis'sors. [Old Fr.] A pair of blades movable on a pin through the middle of both, which cut when the sharp edges are pressed together. The best are made of cast steel or shear steel. Often called a pair of scissors.

Scor'pion. [L.] An arachnidan somewhat like a lobster, having a poisonous sting in its tail. It has a flattened body, and a long, slender lower abdomen, formed of six movable segments, the last of which ends in its sting. Its poison causes pain, but is seldom destructive of life. Scorpions are found in warm climates.

Screech=owl. An owl which utters a shrill cry, and is also called the barn-owl. The screech-owl is small, and of a gray or reddish color.

Screw. [Old Fr.] A round piece of wood or metal with a sloping ridge called a thread running round it for fastening things together. As a mechanical power the screw is a modification of the inclined plane. The flipper of the sea-bear, the wing of the insect, of the bat, and of the bird are screws in principle, resembling the blade of the propeller, and they twist and untwist during oscillation.

Screw'=driver. A tool for driving in screws. It has a thin end to enter in the slot or nick in the head of the screw.

Scut'tle. [AS., from L. *scutella*, a tray.] A broad basket or a vessel for holding coals. In nautical phrase, a small opening or hatchway in the deck of a ship large enough to admit a man.

Scythe. [AS.] A large curved blade fastened to a long handle, for cutting grass, corn, or crops on small farms. Scythe-blades are forged, and then ground on grindstones. The haft is made of bent wood, with two handles.

Sea. [AS.] A large body of salt water smaller than an ocean, though the term is often applied to the whole ocean. The ocean covers nearly 8-11ths of the area of the globe, and its depth averages 2,000 fathoms. The salts in the sea are on an average $3\frac{1}{2}$ per cent., the remainder being water. Of the salts, nearly 78 per cent. is chloride of sodium, 11 per cent. is chloride and bromide of magnesium, and 10 per cent. sulphates of lime, magnesium and potash, with a

very small quantity of carbonate of lime. The usual tint of the sea is bluish-green; but the color of the soil or the color of the sky, and other local circumstances, produce many variations. The sea is inhabited by a vast number and variety of animals, from the simplest forms to the fish, reptiles like the turtle, and mammals like the whales and seals. Many forms are found at great depths in the water, some of these being phosphorescent; some are blind, others have very large eyes. There are also many small phosphorescent animals on the surface, so abundant in places that the ocean seems like a sea of fire.

Sea'=anemone. (*Actinozoa*, or ray-like animals.)

A soft, pulpy polyp with a flower-like or ray-like fringe of tentacles, in the middle of which is the mouth, leading into a hollow sac or stomach. It is of the shape of a column, with a sucking surface in the base that enables it to move much like a snail, but more slowly. From the tentacles are thrown small darts, by which it seizes any crab or worm or small fish for food.

Seal. [AS., from L. *sigillum*, a seal.] An engraved stamp for marking wax or wafer to confirm or make sure.

Seal. [AS.] A flesh-eating animal found in great numbers lying on the icebergs or swimming in the waters of both north and south polar regions. Their sharp-pointed teeth enable them to catch the slippery fish on which they feed. The different kinds of seals vary in size and in the color of their fur. The head, shoulders and



SOLAR CORONA.

chest are round, and the body tapers towards the tail. All their feet are webbed; but the webs of the back feet can be folded up like a parasol, so that they are able to lie close to the body. The webs of the front feet are always stretched out. As the seal lives almost entirely in the water, it has the power of closing both its eyes and its ears. Its body, too, is thickly covered with

double fur, which is kept constantly oiled, so that the fur next the body is never wet. Several species are much hunted for their oils and skins, including the common seal, found in the Atlantic and the Pacific, and the harp seal, abundant in Arctic waters. There are other species in the north Atlantic, while in the southern ocean is found the great sea-elephant, so called from its size and the elongation of its nose into a short proboscis. The males of this species are 20 feet long, the females little more than 10 feet. There are other species known as sea-leopards in the southern waters, while in the north Pacific are the sea-lions and sea-bears. Both of these have long hair, but the sea-bears have also a soft and delicate fur, which is highly valued as the seal-skin of commerce. The northern fur seal has its breeding grounds on some small islands in the Behring Sea. These belong to the United States, and only a limited number are permitted to be killed yearly. The killing of these seals in the open seas by Canadian seal fishers, gave rise to a serious international question between Great Britain and the United States.

Seal'ing-wax. Wax used for sealing letters or for being marked with a seal. Gummed envelopes have almost taken the place of wax for closing envelopes. Wax is made of lac mixed with turpentine and resin; black wax is colored with ivory black, and red with cinnabar.

Seanettle. A jelly-fish or medusa.

Seaurchin. (*Echinus*.) A kind of shell-fish or sea-egg covered with prickles like a chestnut bur, and closely related to the star-fish. The shells are of the thickness of egg-shells, and have rows of dots or knobs with lace-work between, and are made up of hundreds of plates joined like mosaic work. The animals do not cast their shells like crabs, but the flesh secretes lime from sea water, and deposits it round the plates, which increase uniformly. The spines are beautifully carved columns with ball-and-socket joints on the knobs. There are also protruding through holes double rows of tube-like feet, which are supplied with water by a tube opening at the top of the shell. In the centre of the shell is a tube-like stomach opening to the top of the shell. The sea-urchin has also a mouth, intestines, heart, and five teeth. There are many kinds.

Search=light. An electric arc-light of great candle-power, used with a parabolic projector which throws its rays for many miles. It is of great importance on a naval vessel, in enabling the captain to discover an approaching enemy at night. One shown at the Chicago Exposition of 1893 could be seen 85 miles away, and fine print was read by its light at 8 miles' distance.

Sec'retary=bird. The crane-vulture of South Africa and the West Indies. It is easily tamed, but attacks and kills poisonous snakes. Its tail is very long, with two long middle feathers. It has a crest on the back of its head of six pairs of feathers, like the pens behind the ears of a clerk, hence its name.

Secre'tion. A substance separated by any one of the glands from the blood, either to be used for

some purpose in the body or to be discharged as useless and detrimental. Some of the secretions are sweat, saliva, bile, and milk.

Sedan'. [From *Sedan*, a town in France.] A covered chair for one person, carried by two bearers on poles with the hands, and differing from palanquins, which are carried on the shoulders. There are no carriages in the streets of Canton, their absence being supplied by nimble sedan bearers. Sedans were introduced into England in the seventeenth century.

Sedge. [AS.] A kind of coarse grass with blades shaped like swords, and found in swampy ground. It has a triangular jointless stem, spiked inflorescence, and long leaves, rough on the margin and mid-rib. There are several hundred species.

Seed. [AS.] The part from which a new plant grows, consisting of one or more coats or skins and the kernel, which is made up of the embryo and albumen to feed the embryo. Some albumen often forms a part of the embryo. Embryos



SUN SPOTS.

are divided into those with one cotyledon or seed-leaf, as grasses; those with two cotyledons, as the bean; and those with more than two, as pines.

Seid'litz. [From *Seidlitz*, in Bohemia.] A natural mineral water; also a powder having the same effect. The seidlitz owes its aperient property to the presence of Epsom salts (*q.v.*) and a little lime. Seidlitz powder has 2 drams of Rochelle salt and 40 grains of bicarbonate of soda in one paper, and 35 grains tartaric acid in another paper. When mixed these effervesce, and make a very pleasant draught.

Selt'zer. [*Selters*.] A mineral water from Selters, in Nassau, Germany. Its chief character is a large amount of carbonic acid in combination with alkaline carbonates, and also some common salt. It is useful for dyspepsia.

Sem'aphore. [Gk.] A means of signaling invented by Chappe in 1793. Formerly in railway signaling there were three positions: at right angles meant stop; at half a right angle, go slowly; hanging down, that the line was clear. Nowadays semaphores have two positions: when the arm is up, danger; when down, clear.

Sen'na. [Arab.] The dried leaves of a kind of cassia used in medicine as a valuable purgative. It grows abundantly in North Africa, in the West Indies, and in India. Egyptian senna has a high reputation. The leaves are long, lance-shaped, or broad, and are sometimes mixed with angel leaves, which have no veins. Epsom salts mixed with senna is called *black draught*, and is a strong purgative.

Sen'sitive-plant. The *mimosa*, a small plant with leaves which collapse and fold up when touched. It is a native of the American tropics, and is about a foot and a half high.

Se'pia. The cuttle-fish, a family of naked molluscs, with an oval body and with eight short arms surrounding the head, also two long arms or tentacles. It has an internal shell or plate along the back, known as *cuttle-fish bone*. It also possesses a bladder containing a black liquid, which it ejects when pursued, staining the water black so that it can escape. This secretion, obtained from the ink-bag and dried, is used as a pigment called India ink. This, when dissolved in potash, boiled and filtered, precipitated by an acid, and dried, becomes the pigment *sepia*.

Sequo'ia. The giant trees of California. They belong to the family of the pines, and are distinguished by their enormous dimensions, one of them having measured 112 feet in circumference and supposed to have been 450 feet high. The California redwood is a smaller species.

Serge. [Fr., from *L. sericus*, silken.] A kind of twilled cloth, first made of silk, now chiefly of wool, used for garments.

Ser'pent. [*L. serpens*, creeping.] An animal that creeps or winds about on the ground. They are divided into two classes—poisonous, as vipers and rattlesnakes; and snakes that are not poisonous, as boas, pythons, and many others. Serpents are vertebrate animals, without limbs, but some have rudiments of hind limbs. (See *Reptile*, *Snake*.) They are mostly long and slender, and move partly by bending the body into folds, and partly by clinging with their scales to rough surfaces. Many glide, others burrow, and some live in trees.

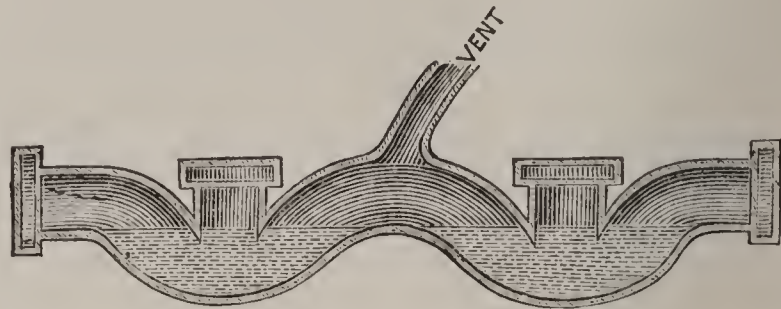
Ser'pentine. A magnesian rock, usually of a greenish color, sometimes spotted like a serpent's skin. Precious serpentine is translucent, and of a rich oil-green color. It is really chrysolite altered.

Set'ter. A dog taught to set or crouch when it sees the game. Originally it was a cross between a spaniel and a pointer.

Sew'er. [Fr.] A drain or passage to carry off sewage in cities. In Paris the sewers contain telegraph and telephone wires, compressed air or gas-pipes, etc. The ancient sewer (*Cloaca Maxima*) of Rome was large enough to allow a loaded wagon

of hay to pass through. Sewerage has become a very important part of modern city administration.

Sew'ing-machine. A machine for sewing, of which the first effective one was introduced by



DOUBLE TRAP FOR SEWER.

Elias Howe in 1846. The Howe machine has a needle with an eye near the point. The thread carried through the cloth by this needle forms a loop under the cloth through which a shuttle passes. The shuttle contains a bobbin of thread, which unwinds as it passes through the loop, and the thread thus put through forms the lock-stitch. In addition to machines for ordinary sewing, there are many special inventions. The most important is the cylinder, with cylindrical feed, for shoe-work, gloves, pocket-books, and traveling-bags. Sewing-machines are now produced that make 2,000 stitches a minute. The button-hole machine can make 1,200 stitches per minute. Sewing-machines are usually fitted with a treadle, to be worked by the foot.

Sex'tant. [*L. sextans*, a sixth part.] An instrument for measuring angles, mounted on a frame, and marked with degrees, minutes, etc. It is constructed on the same optical principle as Hadley's quadrant.

Shad. A fish of the Herring family, but, unlike the herring, with a deep notch on the middle of the upper jaw, and without teeth on the tongue and the roof of the mouth. The Chinese shad is an esteemed food-fish. The European shad is little valued for food. The American is the choicest of food-fishes, and ranks highest among American fishes. It is twenty inches long, is bluish and silvery in color, and is found abundantly in the rivers of the Atlantic coast of the United States.

Shad'dock. A fruit of the Orange and Lemon family, but much larger. It is native to China and India, but is now grown in the West Indies. It is better for preserving than eating, though now, under the name of grape-fruit, it is much used as a dessert fruit.

Shagreen'. A kind of leather made from the skins of horses, wild asses, and camels, and so grained as to leave on it little grains or pimples. These are caused by forcing into the moist skin the hard seeds of an Asiatic plant. Shagreen is made at Astrakan, Russia, and other places. It is used for covering sword scabbards, instrument cases, etc.

Shale. [Ger., akin to *scale*.] A rock easily split into slabs. Bituminous shale is impregnated with bitumen, and often accompanies coal.

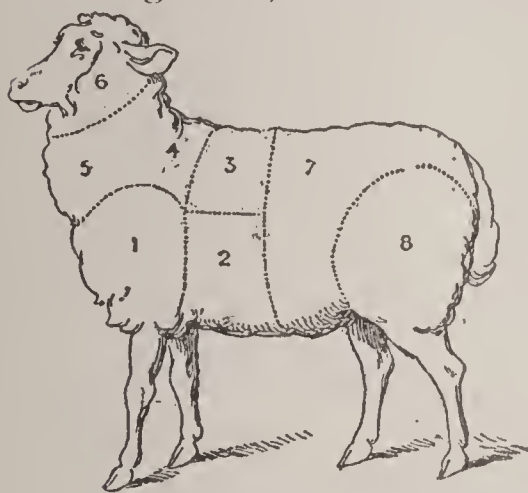
Sham'rock. [Celt.] A three-leaved plant like clover; the national emblem of Ireland.

Shark. A large, fierce, and powerful fish, called the tiger of the ocean. It sometimes reaches a length of 35 feet. It has a strong, stout body, and a tail of irregular shape, its upper section being longer than its lower. Its skeleton does not consist of bone, but of hard gristle; instead of scales its skin is set with hard knobs, and the gill slits on the side of the neck have no covering. Its mouth is on the under side of its head, and it has to turn before biting. It has several rows of teeth pointing backward and imbedded in the lining of the mouth. The female lays two eggs, with leathery cases, that have strings at each of the four corners. (See *Egg*.) The sharks are voracious, and in nearly every case carnivorous. Some sharks, as the basking shark and the whale shark, grow to an enormous size. Most sharks are harmless to man, but some species, as the white and the blue sharks, will attack and devour man. Another species, the man-eater shark, found in all tropical and temperate seas, grows to a length of 36 feet.

Shawl. [Per.] A woven or knitted covering for the shoulders, of wool, cotton, silk, or other textile material. India shawls are made from the wool of the Cashmere goat.

Shears. A large pair of scissors used for cutting wool from sheep or their skins, also the nap of cloth. *Shear steel* is prepared from blistered steel by repeated heating, rolling, and tilting to increase its malleability and fineness of texture. Two or more poles fastened together at or near the top, and steadied by a guy from which pulleys and ropes are hung for lifting weights or unstepping the lower masts of ships, are called shears.

Sheep. [AS.] A most useful ruminant animal, bearing wool, and valued for its flesh. The



domestic sheep is gregarious and very timid. Among fine wool sheep are the merino, the French, the Saxon, and Silesian; among coarse-wool sheep are the South Down, Cotswold, Leicester, and Cheviot. The meat of the fine-wool sheep is not as good

as that of the coarse-wool sheep. The merino sheep is a native of Spain, and valued for its wool. It is now much bred in Saxony, Silesia, Bohemia, and Australia, while in the United States the sheep are 95 per cent. merinos. The merino differs from the English sheep in having wool on the forehead and cheeks. It is a large breed, with heavy horns, and with fine wool curling in tendrils. The Cretan sheep has long horns; the Turkish sheep has a long fat tail, which has often to be supported; the Asiatic sheep has four horns; the Rocky Mountain sheep, a wild species, is called *big-horn*, from its large-

sized horns. The aoudad is an African sheep, having a long mane on the breast and fore legs. The argali and moufflon are wild sheep in Siberia and Sardinia respectively. The musmon is a wild species in European Turkey. The most common mode of cutting up a sheep is—(1) shoulder, (2) breast, (3) loin (best end), (4) best end neck, (5) scrag end neck, (6) head, (7) loin (chump end), (8) leg.

Shell. [AS.] The outer part of an egg or nut, the pod of peas, and the hard covering of some



SPINY SHELL.

kinds of ocean animals. Shell-fish are usually univalves, having one part; or bivalves, having two parts joined with a hinge. Shells are useful for protection, and their strength and thickness are generally in proportion to the dangers to which the animal is exposed. Those in-

habiting shallow places near the shore and exposed to the beating of the waves have stronger shells than those living in deep water. Fresh-water molluscs generally have delicate shells. The thin layers of the oyster-shell are deposits of shelly matter showing the lines of growth. All living shells have an outer layer of animal matter called epidermis, and they have no lustre till this is taken off. Mussel-shells show beautiful blue tints when the epidermis is removed. The bodies of all shell-fishes are enclosed by a delicate membrane called a mantle, which secretes the shell. Among other animals the tortoise has a shell, whose upper part is made of the flattened spines of the vertebrae, and of the ribs, the shelly plates being merely portions of the skin hardened into shell. (See *Tortoise*.) There are many other animals that form shells, some of them being microscopic. Chalk is largely made up of the shells of these.

Shel'lac. [Lac, gum.] Lac or gum hardened and cut into thin plates. (See *Lac*.)

Sher'ry. A kind of light-colored wine, chiefly got from Xeres in Spain. It is colored a straw color or amber color by mixing cheap wine and boiling it down.

Shield. [AS.] A frame covered with skin or metal, worn on the left arm to keep off blows; also the escutcheon or field on which are placed the bearings in coats of arms.

Shil'ling. [AS.] A silver coin of the value of 12 pence or twentieth part of a pound.

Shin'gle. [Cor. from *L. scindula*, a wooden tile.] A thin piece of pine, cypress, cedar, or oak used as a roof tile; loose stones on the sea-shore or in the bed of a river.

Shin'gles. [*L. cingulum*, a girdle.] A disease which spreads round the body like a girdle.

Ship. A large sea-going vessel with masts and sails, particularly one with three masts rigged with square sails. It is made up of hull, deck (*q. v.*), masts, yards, bow-sprit and rigging, ropes and chains. The front mast is the fore-mast, the middle mast the main-mast, and the hindmost the mizzen-mast, and when a fourth is

used, the jigger. A full-rigged ship has from 21 to 24 sails, and a four-masted ship as many as 36 sails.

Ship'worm. A mollusc of unusual shape, whose scientific name is the *Teredo*. It looks like a worm, being long and slender in body. It bores with its cutting shell into wood, and often so riddles ship timbers with holes that they crumble at a touch. At one time these animals destroyed the piles which protected Holland from the sea, and a deluge was averted only by great labor and expense. They make long tunnels in wood which never break into one another.

Shod'dy. A fibrous fabric made of material obtained by tearing refuse woollen goods, stockings, rags, or druggets.

Shoe. [AS.] A covering for the foot, usually of leather. Fine shoes are made by the hand and shaped on a last, or are made by machinery.



ANCIENT SHOES OR SANDALS.

Shoes are largely made by machinery in the Eastern States of America, New York, and Philadelphia. *Wooden shoes*, much used by the peasantry of Europe, are cheap, durable, and comfortable, though clumsy. Shoes made of vulcanized rubber, as a protection against dampness, are much worn as over-shoes.

Shot. [AS.] Bullets or small pellets of lead shot from a gun. In war, some are composed of lead, wrought iron, or cast iron; they are spherical or oblong, and include hollow, solid, and case-shot. Chain-shot was formerly used in naval warfare to destroy rigging. Shrapnel shell is a projectile for a cannon, consisting of a shell filled with bullets and a small bursting charge to scatter them at any point while in flight.

Shov'el. [From *shove*.] A broad, slightly-hollowed blade with a handle for lifting and throwing earth, coal, grain, or other loose substances. A *steam-shovel* is a machine with a scoop or scoops, worked by a steam-engine, for excavating the earth in railway cuttings.

Shrew=Mouse. An animal brown in color, and very like a common mouse, except that the nose is much longer and more pointed, the stomach is

white, and the tail is square instead of round. These little creatures are treated very cruelly. In some places many people believe that the bite of a shrew is poisonous, and that if one merely runs over the foot of a man or an animal sickness or even death will follow. The American water-shrew has fringed feet. The old Egyptians worshipped the shrew. Many mummies of this little creature have been found in their temples. In Scotland it is sometimes called the ranny; and also the fetid mouse, it having a musky smell, so strong that cats will not eat it, though they kill numbers. Like the mole, it makes long tunnels under the earth in search of food; but it makes its nest above the ground in any little hole it can find. Some of them are the smallest of all mammals.

Shrimp. [O.E.] A small crustacean, used as food, with a thin body, long feelers, and 38 legs of different lengths. Between its head and tail it has thin shells in six parts, jointed, and each working into its neighbor. Its tail is wing-shaped, and helps it to swim or jump through the water, and can be expanded or folded up. The larger kinds of shrimps are called *prawns*.

Shrub. [AS.] A tree-like plant or bush with no trunk but with several stems branching directly from one root.

Shut'tle. [AS.] That by which the weaver shoots or throws the thread from one side of the web to the other. The *shuttle race* is a shelf in the loom beneath the warp along which the shuttle passes.

Shut'tlecock. A cork with feathers, driven back wards and forwards by a light bat in the game of shuttlecock and battledore.

Sick'le. [AS.] A curved steel knife for cutting grain. The sickle has one side of the blade notched, so as always to sharpen with a serrated edge. The reaping-machine has now taken its place in harvesting operations. A grass hook or sickle is used for trimming grass borders or lawns where mowers cannot be used.

Sien'na. A reddish-brown pigment made from earth got from Sienna in Tuscany. This clay is colored by the oxides of iron and manganese. *Burnt sienna* is the same clay made redder by the action of fire.

Sieve. [AS.] A vessel with small holes in the bottom for separating fine particles from coarse ones. It is usually shallow, with the bottom made of wire, hair, or woven into meshes.

Sil'ica. [L.] The substance of which flint, sand, and sandstone are chiefly composed. It is the oxide of the element silicon, and is very abundant in the form of quartz. *Silicates* are salts of silica or silicic acid.

Silk. [AS., from L. *sericum*, silk.] Fine threads spun by silk-worms, but especially the *Bombyx mori*. The silk-worm was first kept in China for the purpose of manufacturing silk. From silk-worms' eggs, in about a fortnight, little caterpillars two inches long and light-colored come out; these must be fed with mulberry (*q.v.*) or lettuce leaves. In about a month the caterpillars

reach their full size, and inside their bodies is a sticky substance which they convert into silk. From two little holes in its head each caterpillar draws out flossy threads of the sticky matter, and twists them together by means of a gum, winding them round and round its body until it is enveloped in a ball of silk, called a *cocoon*, which is about as large as a grape or a pigeon's egg. The cocoons from which silk is to be obtained are heated in an oven, and the inner balls are thrown into warm water, so as to melt the gum; after which the silk from them is wound upon reels, and then made up into hanks. It is then known as *raw silk*. The thread of a single cocoon generally measures about 600 yards, but some cocoons have measured 1,200 yards. The silk fibre is sent to the factories, or silk-mills, as they are called, where it passes through the processes of winding, cleaning, twisting, weaving, dyeing, and finishing. Silk is made into silk for dresses, satin, velvet, ribbon, sarcenet, stockings, fringes, buttons, gloves.

Silk-worm. The worm which spins or produces silk threads. For thousands of years the Chinese would not allow the eggs of the silk-worm to go out of the country. About 550, two monks are said to have brought to Europe a few eggs hidden in their canes. Now it is quite domesticated, and has been so long fed by man that the female is nearly as motionless as if she had no wings, and the male merely flutters without leaving the ground.

Sil'ver. [AS.] A soft, white, shining metal which takes on a bright polish. It is found in combination as sulphurets and oxides, and with other metals. It is widely diffused. Of mineral ores associated only 1 in 17 is free from silver, and traces of it have been found in sea-water and in organic substances. Gold never occurs in nature apart from silver, and is also found with lead; yet there is a natural distinction between the veins of the several metals. The main sources of the world's supply, after the discovery of America, were Mexico and South America; but the United States on the Pacific slope now yields silver in excess of any other country.

Si'phon. [Gk.] A bent tube, with one arm longer than the other, for drawing off a liquid from one vessel to another at a lower level, the shorter arm being inserted in the liquid at the higher level.

Skate. [Scand.] A large flat fish more or less square in form, and the thinnest of ray fishes in proportion to its bulk. It is the largest of ray fishes. The European blue or gray skate is used as food, and sometimes weighs as much as 200 lbs. The American smooth or barn-door skate is also a large species, measuring often 3 feet across. Its nose is conical, and it has sharp spines above its eyes. Its jaws are covered with small, sharp-pointed teeth.

Skeleton. [Gk. *skeletos*, dried.] The bony framework of an animal body. That of the human body is composed of 246 separate bones. At the joints the bones are joined together by bands of a substance like gristle. The use of the skeleton is to

form a foundation—a kind of stiff framework—on which the rest of the body can be built up. The bones of the head enclose and protect the brain; the bones of the trunk perform a similar office for the organs situated in the chest and the abdomen; the bones in the limbs impart rigidity to them, and aid us in performing work and in moving about. (See *Bone*.)

Skin. [Scand.] The natural covering of animals and plants. The thickness of the skin varies in different parts of the human body, from one-eighth to one-fourth of an inch. On the hands and feet it becomes thick (or callons), but in other parts it is thin and delicate, while at the ends of the fingers and toes it grows into thin plates called nails. The hairs are only portions of the skin grown very long and narrow. The skin is composed of *two layers*: there is a lower, thick layer, full of the fine blood-vessels called capillaries, and full, too, of nerves—this layer is called the *dermis*; upon it lies an upper, thin layer, of a horny or scaly nature, in which are *no* blood-vessels and *no* nerves—this is called the *epidermis*. Just under the dermis there is usually a layer of fat. When we examine the outside of our skin through a magnifying-glass, we can see great numbers of little holes or pores. No fewer than 5,000 pores have been counted in the skin forming the tip of a finger; and there are about $2\frac{1}{2}$ millions of such pores in the skin of the whole body. Each pore is the end or opening of a tube called a sweat gland, which goes down, through the epidermis, into the dermis, where its lower end is coiled up into a little ball or knot. The oil glands are very similar to the sweat glands. Two are attached to each hair; and when the skin is in a healthy state this natural oil ought to be sufficient for the hair. The oily matter formed by these oil glands runs out on the skin and mixes with the sweat. The sweat produced by the skin of an ordinary man or woman every twenty-four hours measures not less than a pint and a quarter, weighing $1\frac{1}{2}$ lb.

Skull. [Scand.] The bony case which encloses the brain, and with the bones of the face and mouth gives shape to the head. It is rounded on the top somewhat like the large end of an egg, and in front and on the sides it has openings for the eyes, the nose, and the ears. The skull is made up of compact plates, joined by irregular saw-like lines or projections called sutures. The upper jaw and the bones of the nose and cheeks belong to the skull, and are immovable. The use of having the skull in several parts is to allow the brain to grow, and to prevent a jar from affecting the whole skull. In many fishes the skull is almost wholly cartilaginous, with a layer of spongy bones.

Skunk. [Ind.] An animal of the Weasel family, found only in America. There are eighteen species, of which the common skunk is found in the rocky parts of North America. It defends itself by giving out liquid secreted in two glands near the anus, the scent of which is so nauseous and persistent that it forms an effectual defense against other animals. It is about the size of a

cat, with a broad body standing low on the legs. Its fur is coarse, the hair long, and the tail long and bushy. The claws on the fore feet are strong and suited for digging. It preys on mice and frogs. It does not run from its foes, its elevated white tail being a sufficient warning to all carnivorous animals, none of which will attack it. The common skunk is black, with white on the body and tail. The spotted skunk of Mexico is smaller, and is also marked with black and white. The skunk is hunted for its fur, which is in con-



siderable demand, but the hunter must be careful to avoid alarming the animal and causing it to discharge its obnoxious secretion.

Sky/lark. A bird which nests in the grass, but rises high in the air, singing as it rises. (See *Lark*.) The Australian skylark is a pipit, and though it rises it lacks the song of the true lark.

Slag. [Scand.] The dross of melted mineral, or cinders from a volcano.

Slate. [Fr.] A kind of rock which splits into thin layers very readily. The largest slate quarries in the world are in Wales. Welsh slates are lightest and best. They are used for covering roofs, for cisterns, for mantelpieces, and for writing upon. Slate is very useful for roofing purposes, since it is cheap, light, and impervious to water. Slates are fastened to the rafters with nails, and are placed so as to overlap one another.

Sling. [AS.] A strip of leather, having a cord attached to each end, for throwing stones by rapidly whirling round the head and suddenly letting one of the ends go; also a bandage hung from the neck to support the arm or hand.

Sloe. [AS.] A small bitter wild plum, the fruit of the blackthorn (*Prunus spinosa*); also the tree itself.

Sloop. [Du.] A one-masted ship with fore-and-aft sails. The typical sloop has a fixed bowsprit, top-mast, and standing rigging, but those of a cutter can be rapidly shifted.

Slot-machine. An ingenious instrument so arranged that its machinery is set in motion by the weight of a cent, a half-dime or other small coin. Slot-machines in great variety have been made, some adapted to set in action a weighing apparatus, others to drop out small articles, when the coin is dropped in. Among the latest devices is one to give out railroad tickets in exchange for the proper coin, used on the German railroads.

Sloth. [AS.] This is a curious creature without fore teeth and canines. It is a native of Central and South America. Its shape is very different from that of gnawing animals, for its front legs

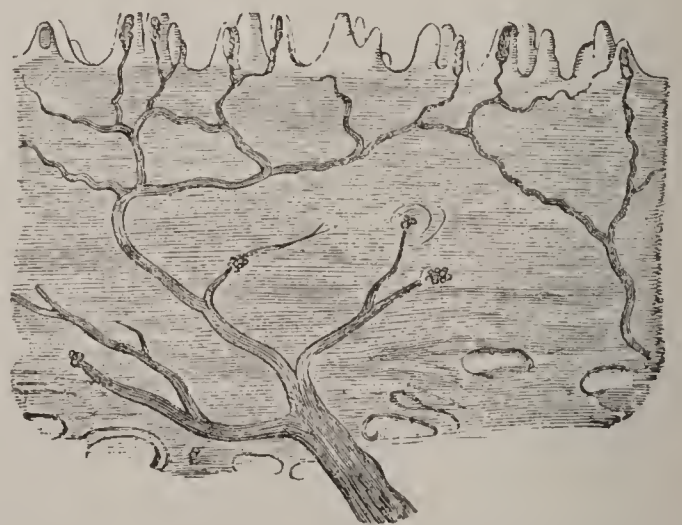
are longer than those behind. Some sloths have three, others two, large strong curved claws to each foot. The two-toed sloths have two toes on the fore foot and three on each hind foot. These the sloth hooks round the branch of a tree, and hanging with its back downward moves with great speed among the thick forests. Its strong coarse hair is so like the color of the trees that it is not easily seen among the branches; and there it has no enemies to fear except men and snakes. The natives of South America hunt it for its flesh, of which they are very fond. On the ground it moves with a slow, awkward shuffle, hooking its strong claws into the ground, and dragging itself along. When attacked it throws itself on its back, and tries to choke its enemy with its powerful arms. It lives on leaves and twigs, and completely strips one tree before it begins to strip another.

Slug. A land-dwelling mollusc, without a shell, except a small internal one which protects the heart. The slugs are the pests of gardens and cultivated places, and give much trouble to gardeners.

Sluice. [Old Fr., from *exclusa*, shut out.] A door or gate, sliding in a frame, for shutting off or regulating the flow of water; also a long box used in washing for gold.

Smelt. [AS.] A small salmonoid fish which ascends rivers to spawn, much esteemed for food. It has a peculiar odor.—*Candle fish* is a kind of smelt found on the North Pacific coast, and is so oily that it may be used as a candle by drawing a wick through it.

Snail. [AS.] A soft slimy land mollusc, usually protected by a spiral shell. Besides long tentacles tipped with black eye-specks, snails have a shorter pair, which are organs of smell. There are over 2,000 species of snails, and they are found in all parts of the world except the Arctic regions. Some are even smaller than a pin-head;



SECTION OF THE SKIN MAGNIFIED

while others, in France and Italy, cultivated for food, are fairly large. The Great Vine Snail was considered a table luxury by the ancient Romans. Snails are vegetarians, and have jaws and tongues of saw-like edge, with thousands of rasping points on each. On the approach of cold weather the

snail throws a film over the mouth of its shell, which tightens like a drum-head. Snails have astonishing vitality. They regain activity after having been frozen in solid blocks of ice, and endure a degree of heat for weeks which daily crisps vegetation. In very dry weather they close up the shell as in cold weather, to retain the bodily moisture.

Snake. [AS. *snaca*, creeper.] A creeping reptile, whose gliding motion is due to having the vertebrae jointed with ball-and-socket joints. On each vertebra is a pair of ribs which are used as legs, working the snake backwards and forwards; and its scales are used as feet, catching the ground and pulling or pushing the whole body. Its jaws are joined by an elastic gristle, so that they can be spread wide; and its tongue darts far out beyond its lips, touching or feeling. Its teeth are not used for chewing but for holding and swallowing its prey. There are the black snake, blind snake, garter snake, green snake, ring snake, rock snake, milk snake, water snake, and dwarf snake, and various venomous snakes, such as the rattlesnake and the copperhead. The python is sometimes 30 feet long, and the female incubates her eggs. (See *Boa*, *Cobra*, *Rattlesnake*, *Serpent*.)—*Snake-bird* or *darther* is a kind of gannet with a snake-like neck.

Snap'ping-tur'tle. The common name of a family of reptiles, comprising turtles with the body high in front, low behind, large head, long neck, powerful jaws, tail long and strong. If assailed they raise themselves on their legs and tail, throw the body forcibly forward, and snap the jaws with great power upon their foe. They are a match for any enemy likely to attack them except man. They are frequently found upon the land near the water, devouring small animals. There are three species, two of which are American. They are hunted for their flesh, which makes a rich and palatable soup.

Snipe. The common name of a large family of birds, found in many parts of the world. The common snipes of Europe and America are much alike in size and plumage, being about 17 inches in total length, of which the bill is nearly 3 inches. They fly very swiftly and in a zigzag manner, and are difficult to shoot, though much hunted as a delicious game bird.

Snow. [AS.] Frozen moisture falling in soft white flakes. It is not produced, like hail, by the freezing of rain-drops, but formed by the direct passage of the vapor into the solid state. It falls to the earth in flakes, each flake consisting of a regularly shaped crystal, or, as more commonly happens, of several crystals grouped together. The most common form is that of six-pointed stars variously modified. Each star has a solid nucleus, from which six little rods of ice proceed at regular angles, and from the sides of these rods secondary rays may be given off, producing a countless variety of very beautiful figures. The snow-flakes are largest when the temperature is near the freezing-point, the snow being then soft and easily gathering into masses. The texture of snow being very loose, it is a bad

conductor of heat; and being also a bad radiator on account of its white color, it forms an admirable covering for plants, shielding them from the effects of severe frosts.

Snow=bunting. An American bird, common in summer in the Arctic regions and in winter in the United States. It resembles the lark in its habits, and is generally very fat and much esteemed for the table.

Snow-drop. A small bulbous plant, with white dropping or hanging flowers, often appearing while the snow is on the ground.



SNOW CRYSTALS.

Snow=line.

The line on a mountain above which snow never melts. The lowest limit of perpetual snow in the Alps is at 9,000 feet above sea-level, and in the

Andes, at the equator, 16,000 feet.

Snow=shoe. A flat shoe worn to keep the foot from sinking in the snow. The frame of wood is three or four feet long and about a foot wide, with thongs or cords stretched across it, and having a support and holder for the foot.

Snuff. [Du.] Tobacco or stalks of tobacco finely powdered taken into the nose. It is scented with essential oils or otherwise. It was formerly much used, but is now very little.

Soap. [AS., akin to L. *sapo*.] A mixture of oil or fat with soda or potash for washing. Since the cheapening of caustic soda by the Le Blanc process, soda is chiefly used instead of potash as the alkali of soap. Common soap is a compound of fat or oils (*q.v.*) and caustic soda. Many kinds of soap are made, but they all consist of some fatty substance (as tallow) boiled with an alkali—either caustic soda or caustic potash. *Yellow soap* is made from tallow and caustic soda colored by rosin; *mottled soap*, from dripping, etc., boiled with caustic soda; *Castile soap*, from olive oil and caustic soda; *brown windsor*, from equal parts of tallow and olive oil boiled with caustic soda; *white* or *curd soap*, from tallow and caustic soda. *Transparent soap*, is made by dissolving curd soap in spirits of wine. *Marine soap*, is made from cocoa-nut oil and caustic soda; it will dissolve in salt water (which common soap will not do), and is therefore much used on board ships. *Soft soap* is made by boiling caustic potash with some fish-oil.—*Soapstone*, or *talc*, is a silicate of magnesia used to make stoves, hearths, crayons, etc.

So'da. [Ital.] A substance formerly got from sea-weeds, and in 1791 it was produced from common salt by Le Blanc. In this process salt is transformed into sodium sulphate by adding sulphuric acid; then by mixing with chalk and

coal it is made into sodium carbonate. Soda can be produced by electricity from brine. It is the most important of all chemical products used in the industries. *Caustic soda*, or sodium hydroxide, is used in making soap, wood pulp for paper, etc.; *cooking or washing soda* is sodium bicarbonate.

So/da=water. Water mixed with a little soda and carbonic acid; a beverage consisting of water highly charged with carbonic acid, to which fruit syrups are usually added.

So/dium. A common metallic element of the alkali group, always found combined, as in common salt. When isolated it is a soft, waxy white metal, so readily oxidized that it combines with water and must be preserved under petroleum. As a means of obtaining magnesium and aluminium, sodium is an important article of commerce. Its compounds are widely diffused in nature, and can be detected by the peculiar yellow color which they impart to a flame, or by the yellow line in the spectrum.

Soil. [Fr., from L. *solum*, ground.] Earth in which plants grow. Soil consists of a mixture of earthy materials resulting from the disintegration of the rocks by natural agencies, and a deposit of organic matter arising from the growth and decay of vegetation on the earth's surface. The influence of earth-worms, ants, and other small creatures on the condition of the soil has lately been shown to be considerable.

So/lan Goose. [Scand., *Sula*.] The gannet (*q.v.*).

So/lar Spec'trum. [L.] The spectrum of solar light, characterized by numerous dark lines, called *Fraunhofer lines*, from being observed by a German physicist of that name. [See *Spectrum*.]

So/lar Sys'tem. [L.] The sun, with the bodies revolving round it, and receiving from it their light and heat, and held by its attraction. It includes eight planets with twenty-two satellites, of which the Earth has one, Mars two, Jupiter five, Saturn nine, Uranus four, and Neptune one. There are more than four hundred asteroids, or very small planetary bodies, known between Mars and Jupiter. The meteoroids furnish the zodiacal light and the rings of Saturn. The year of Mercury is nearly 88 days; of Venus, nearly 225 days; of the Earth, over 365 days; of Mars, nearly 687 days; of Jupiter, nearly 4,333 days; of Saturn, over 10,759 days; of Uranus, nearly 30,687 days; of Neptune, over 60,181 days. The four outer planets are very much larger than the interior ones. There are many comets included within the solar system.

Sol'der. [Fr., from L. *solidus*.] Melted metal used for fastening pieces of metal together. *Hard solder*, for fusing at red heat, is composed of zinc and copper or silver and copper. *Soft solder*, for low temperature, in use among plumbers, consists of two parts lead and one part tin.

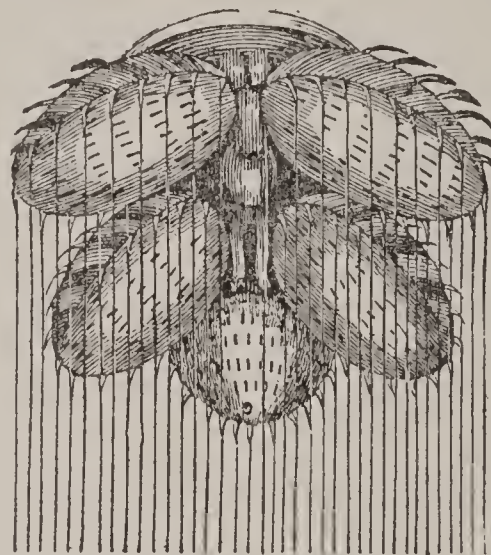
Sole. [L.] A kind of flat-fish of the genus *Solea*. The common sole of Europe is much used for food. Lemon or French sole is another species. The megrim is the British smooth sole or scald fish.

Sol'stice. [Fr., from L. *solstitium*.] The point in the ecliptic at which the sun is farthest from the equator, either north or south, and at which it seems to stand still. The 21st of June is the summer, and 21st of December the winter solstice; for some days before and after these dates the length of day is very similar. Both points are $23^{\circ} 28'$ from the equator.

Soot. [AS.] The loose black particles from smoke in chimneys disengaged from the fuel in process of combustion, consisting chiefly of carbon, and the result of imperfect combustion.

Sor'el. [Fr.] A plant like the dock, whose leaves have a sour taste. *Mountain sorrel* has rounded kidney-formed leaves. *Red sorrel* is found in the West Indies, and the calyxes and capsules are used for making tarts and acid drinks. *Salt of sorrel* is binoxalate of potash, and is obtained from common sorrel or *Rumex acetosa*.

Sound. [Fr., from L. *sonare*.] That which can be heard. In physics, it is applied to the external cause which produces the sensation. In this sense the word *sound* stands either for the vibra-



SPINNERET OF SPIDER.

tions of the sounding body or for the impulses it has communicated to the air, and which immediately affect the ear. It can be shown by experiment that sound is the result of a vibratory movement which when sufficiently rapid produces a sound. A bell, a glass plate, a tuningfork, a piano string, if put into a state of vibra-

tion, will produce a sound if the vibrations take place in a suitable medium. It has been found that sound is not transmitted in a vacuum. A bell struck in the exhausted receiver of an air-pump is nearly inaudible. In water, sound travels nearly four times as fast as in air, in which its speed is about 1,093 feet per second. In solids the velocity varies widely. In inelastic substances like lead or wax it is small, while in those like wood and steel it is large. Musical sounds differ from one another in respect to *intensity*, *pitch*, and *character* or *timbre*. The intensity depends upon the amplitude of the vibrations. Pitch is the quality which distinguishes an acute sound from a grave one. It depends upon the frequency of vibration. As with other forms of wave motion, sound may be reflected and refracted; and if not in accord with each other their interference gives rise to beats.

Soup. [Fr.] Water with meat or vegetables boiled in it and used for food. *Soup maigre* is made chiefly from vegetables or fish, with a little butter and a few condiments.

Sov'reign. [Fr., from L. *supremus*.] A British gold coin worth twenty shillings.

Spade. [AS.] An instrument for digging, having a broad oblong and nearly rectangular flat blade, usually of iron, with a wooden handle.

Span'iels or Spanish Dogs. Handsome animals with long silky hair, drooping ears, bushy tails, and feet partly webbed. Water spaniels are good swimmers, and field spaniels can fetch game. Blenheim and King Charles spaniels are lap-dogs.

Spank'er. [AS.] A fore-and-aft sail on the mizzen-mast attached to a boom and gaff.

Spar'row. [AS.] The Sparrow family is a numerous one of perching birds. They help the farmer by keeping down caterpillars, grubs, and insects, which would otherwise overrun the fruits and crops; but they are very combative and drive other birds away. The white-throated American sparrow has a black crown, yellow spots over the eyes, orange edges on the wings, and a white throat. It is called the peabody bird from the sound of its note. The English sparrow, introduced into the United States to destroy the caterpillars of the tussock moth, which are injurious to shade trees, has greatly multiplied and is the common bird of cities and towns. The hedge sparrow is the size of the robin, and belongs to a different family. Its beak is black and rather long and slender. The solitary sparrow is a species of thrush, and is a native of Southern Europe. It resembles the blackbird, and has bluish feathers. The Sparrow family includes finches, swallows, thrushes, and larks. (See *Beak*.)

Spar'row-hawk. A small hawk which preys on sparrows and other small birds. It is the most pernicious of hawks, feeding on pigeons, partridges and young fowls. It is bluish gray in color, with a cream-colored breast. It builds in hollow trees or in ruins. It is found in large numbers all over the world. It lays four or five eggs of a white color, spotted with red.

Spear. [AS.] A long shaft of wood, with a sharp iron point, used in fighting, hunting, or in catching fish.

Spear-fish. A large, powerful fish found in the Mediterranean, related to and somewhat like the sword-fish. It has scales and ventral fins.

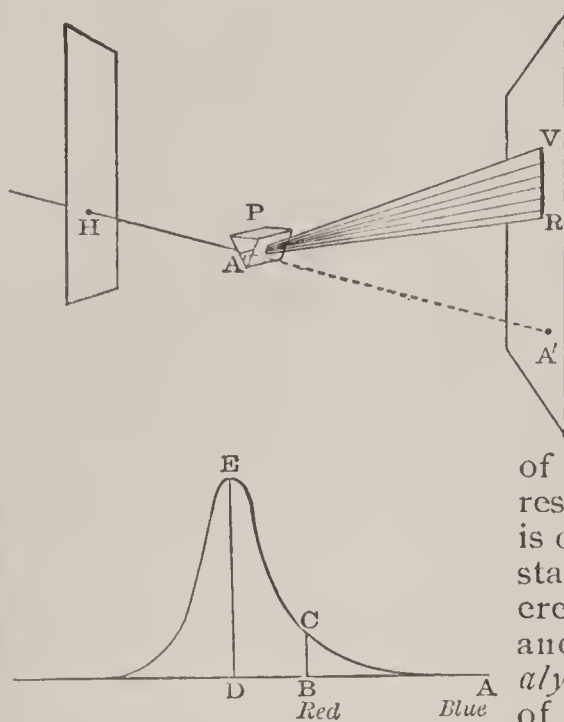
Specif'ic Heat. The quantity of heat required to raise the temperature of a pound of a substance one degree, taking as a unit of measure the freezing point quantity required to raise one pound of water at one degree. The specific heat of mercury is 0.033, that of water being 1.

Spec'tacles. [L.] Two glasses set in a light frame to help weak sight. They were invented by an Italian in the thirteenth century. For short-sighted eyes, spectacles with concave lenses are used, which form an image of the object nearer to the eye than the object itself. For long-sighted eyes, spectacles with convex lenses are used, which form the image at a greater distance from the eye than the object.

Spec'troscope. [L. *spectrum*; and Gk. *skopeo*, I see.] An instrument consisting of a telescope with a prism for separating the rays of light proceeding from the sun and stars or from burning substances, so that, by the relations of the

lines to one another, the composition of the substances burned may be ascertained.

Spec'trum. A ray of light separated by a prism or otherwise into the colors of which it is composed. There are seven different bands of color—red, orange, yellow, green, blue, indigo, and violet. The spectrum of solar light or that of the light given off by burning bodies, is found to be



crossed by very many dark lines or spaces where the light is interrupted. These are known from their discoverer, as the Fraunhofer lines. If the substance burned is a gas, its lines are bright instead of dark, and the rest of the spectrum is dark. Each substance makes a different set of lines, and *spectrum analysis* is a method of examining the

lines in any ray of light and determining by them what substance yields the ray. By this means it has been found that many earthly substances exist in the sun, such as hydrogen, iron, sodium, etc. Similar substances have been found in very distant stars. Many of the nebulae give a spectrum of bright lines, from which we conclude, that they are composed of luminous gaseous matter.

Spec'ulum. [L.] A piece of polished metal which acts like a mirror, as in a reflecting telescope. Silvered glass mirrors being lighter and more easily made, have taken the place of metallic mirrors.

Spermace'ti. [L. *sperma*, seed; and *cetus*, a whale.] A kind of fat from the head of the sperm whale used in making candles, ointments, and cosmetics. It is a semi-fluid substance which, on being taken from the animal, hardens as it cools. The large head is partly occupied by a cavity containing spermaceti, and other cavities throughout the body are also filled with it. It consists of salts of palmitic acid and ethal and hydrocarbon bases.

Sperm Oil. Oil got from the sperm whale. It is a thin and valuable oil, and, like spermaceti, is used in ointments and medicine. It is slightly pressed from the other matters with which it is mixed, and one animal has been known to yield 6,000 gallons of this oil.

Sperm Whale. A kind of whale called also cachalot, from which sperm oil and spermaceti are obtained. Sperm whales frequent tropical seas and live in groups or shoals. They have large, square heads, with a single blow-hole near the extremity of the snout. They have no whalebone plates in the mouth, but the lower jaw is furnished with large, conical, curved teeth, and

when the mouth is closed the teeth fit into cavities in the upper jaw. They sometimes grow to the length of 80 feet.

Sphere. [Fr., from Gk. *sphaira*, a ball.] A round body; also the apparent surface of the heavens, which is assumed to be spherical and everywhere equally distant, in which the heavenly bodies appear to have their places.

Sphinx. A fabulous monster of classic lore, with the head and bust of a woman, the body of a dog, wings of a bird, and tail of a serpent. The Egyptian sphinx was a winged lion with a human head and bust. This creature was carved in stone, and set up in rows as approaches to the great temples. The Great Sphinx, near the Pyramids of Egypt, is 62 feet high.

Spice. [Fr., from L. *species*.] A vegetable production, with a strong, sweet smell and sharp taste, used as a seasoning by mixing with food. The chief spices are ginger, cinnamon, nutmegs, cloves, allspice, and pepper (*q.v.*). Allspice or pimento is a native of Jamaica, and is an evergreen tree. The berries are dried and much used for flavoring, as they contain the flavor of other spices.

Spic'ules. Needle-shaped objects in sponges, which retain the shape of the sponge when the flesh is removed. Flints (*q.v.*) are filled with fossil spicules.

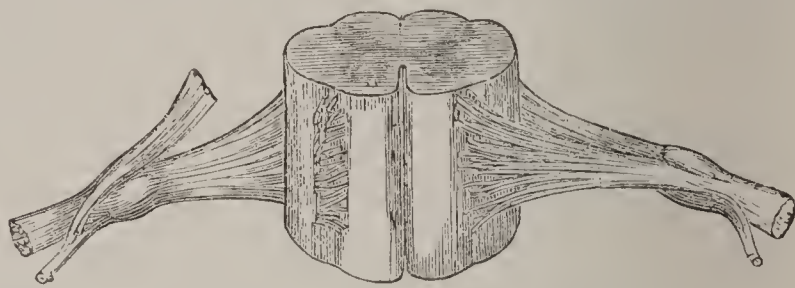
Spid'er. [AS., from *spin*.] An animal allied to the insects, which spins a web in order to catch flies for food. There are two divisions in the spider's body. The upper, or head part has a horny covering, and is united to the abdomen by a short stalk. Spiders have four pairs of legs, ending in hooks. Near the mouth are hooked teeth which have slits at the ends from which a poisonous fluid is ejected. There are eight eyes on the back of the head. Some spiders spin no web, but jump upon their prey; others, as the tarantula, run it down; but most snare their prey by traps in the form of exquisite webs. The webs of the house spider and cellar spider are woven in many shapes, but the garden spider weaves a geometrical web. At the end of the abdomen of the spider are from four to six spinnerets covered with tiny points, from each of which flows a gummy fluid which hardens into silk when it reaches the air. A web is fastened to an object by simply touching the spinneret with the object. Having arranged the long rays or spokes, a spiral thread is run round and round. Then a silken den to hide in is built near by, with one long thread by which she can feel if a fly strikes the net. Nearly all spiders enclose their eggs in a cocoon, which sometimes the mother carries on her back. Gossamer spiders send out long floating lines which carry them through the air. The water spider makes a bell-shaped cell under the water, and takes down a little bubble of air into the bell to supply it with air. The trap-door spider lives in warm countries, and has a nest in the ground lined with silk and covered with a lid made by layers of earth and alternate webs fixed to the nest to make a hinge. From the gossamer web of the garden spider are

taken the fine threads which are stretched across the lens in the astronomical telescope for accurate sighting.

Spike. [L. *spica*, an ear of corn.] A piece of pointed iron or an ear of corn.—*Oil of spike* is a colorless or yellowish aromatic oil from broad-leaved lavender, used as varnish and as medicine.

Spin'ach. [Ital. from L. *spina*, a thorn, or *Hispania*.] A vegetable used for food, some varieties having thorny or prickly leaves, belonging to the Goosefoot family, grown in almost every country. It is (also) called *Spinage*.

Spinal Cord. A long, round mass of nervous matter situated in the cavity of the spinal column. The brain is a soft mass of gray and white nerve-matter, about three pounds in weight, which fills the interior of the skull. From it a cord of nerve substance, about as thick as the little



finger, and some eighteen inches in length, passes downwards from the brain along the centre of the backbone. This is called the spinal cord. Long but very fine nerves extend from the brain and the spinal cord to all parts of the body.

Spinning. [AS.] Drawing out and twisting fibres into threads. Long threads are spun by *mule* spinning-machines, which carry hundreds of spindles. The spindles are set and run swiftly in one long straight row on a wheeled frame, which backs off and returns with them all at once. Ring-spinning or warp-spinning is twisting the thread used for warp. As it is spun, it is wound on small bobbins and rewound on larger bobbins or spools, and then wound on large rollers the same width as the cloth to be made. It is then starched and dried before weaving into cloth.

Spitz Dog. A breed having erect ears and long silky hair, and called also Pomeranian.

Sponge. [Fr., from the Gk.] The animal occupying the lowest rank among the many celled animals, and next above the Protozoa, or single-celled animals. It consists of a network of horny or fibrous substance, or of lime or silica. This is covered and filled with a slimy flesh, through which run numbers of tubular passages. The sponge remains in the place to which it is attached under water, drawing in water and letting it out again, and feeding on the particles in the water. Coarse sponges are fished up with harpoons. Men dive for the fine sponges, and cut them off with knives, and the skeletons washed of their slimy flesh and dried are the sponges of commerce. The large bath-sponges come from the Mediterranean and the Bahamas. The zimocca comes from the Mediterranean. The yellow hard-head sponge is found in American waters on the Florida coast. It is dense, thick,

and hard. The finest, softest, and most delicate sponge is the Turkish toilet sponge, from the Red Sea, the Indian Ocean, and the Grecian Archipelago. Sponges are of all shapes and colors—like a vase, trumpet, globe, or branch of a tree. Neptune's cup is a curiously-shaped sponge. Venus's flower-basket is made of glassy threads. Sponges are useful for the bath, are made into a kind of cloth as a foundation of carpets and rugs, and are sometimes used to stuff cushions.

Spoon'bill. A long-legged wading bird akin to the heron, having a bill like a spoon. Its bill is wide and flattened at the tip, and it scoops up its prey. Like the heron it fishes, and like the duck it searches for worms in the mud. Its color in the first year is a dark chestnut, the second year it changes to red, and the third year to bright scarlet. The royal spoonbill of Australia is white, and the male has a crest.

Sprat. [Du.] A small fish somewhat like young herring or the pilchard. The sprat is marked by a deeply-serrated abdomen, while the young herring is without this. Sometimes called a garvie. (See *Whitebait*.)

Spring. [AS.] An outflow of water from the ground. The water of springs consists of rain-water which has soaked into the ground and percolated through the rocks, sometimes for a distance of several miles. Water easily passes through porous rocks, such as sandstone, but it cannot pass through clay. It then travels along the junction of two strata for a greater or less distance until it finds its way to an outlet and



INTERMITTENT SPRING

reappears at the surface as a spring. Springs of this simple character are very common, and are known as *surface springs*. An *Intermittent Spring* is one that flows and stops alternately being connected with a reservoir (*b*) by a sutured siphon (*a*). *Mineral springs* have mineral ingredients, which they hold in solution.

Spring'bok. [Du.] A South African gazelle, noted for its swiftness, springing action, and

graceful form. It has a white stripe on the back and tail.

Spring=tide. The highest tide at or soon after new and full moon. It rises higher than the average tide. (See *Tides*.)

Spruce fir. [From *Prussia*.] A kind of fir, but unlike firs in having pendent cones with persistent scales and leaves arranged round the shoots. The sprouts are used to flavor



SQUIRREL.

spruce beer and the wood is used for fences, boat building, cooperage, etc. There are many varieties in Norway and the north-west of America. Frequently seen in parks.

Square. [Fr., from Ital.] Having four equal sides and four right angles. In *carpentry*, the square has at least one right angle and two or more straight edges. It includes a carpenter's square, L, a T square, and a try square.

Squash. The fruit of a species of the gourd plant, to which the pumpkin and melon also belong. It was grown in America by the Indians before the whites came; also in Europe in early times. It is smaller than the pumpkin, the chief kinds being the round flat ones with scalloped edges and the long crook necks. An English variety is the vegetable marrow or egg-squash. It is much used in New England in pies, and is a common table vegetable throughout the United States.

Squid. Any one of numerous species of cephalopods with ten arms, a long, tapering body, and a caudal fin on each side. The squid is abundant in the North Atlantic, and is used as bait in cod-fishing. It is also known as calamary, and has a sac of ink-like fluid, which it discharges from a siphon tube to hide it from its foes. (See *Sepia*.)

Squir'rel. [Low L., from Gk.] A beautiful little gnawing animal, of different colors and sizes, found in all parts of the world except Australia. The tail is not only the squirrel's greatest ornament, but is of the utmost use to it in leaping. The hairs stretch out on both sides like a fan, and serve to guide the animal. The flying-squirrel is so called from its having a skin, as thin as paper, but covered with fur, stretching between the front and hind legs, which makes a kind of wing, with which it can jump from tree to tree. It is found in Java, India, America, and Siberia. The common red squirrel lives among trees, building a round nest at the top of a very high tree. It eats nuts, acorns, and corn, and

lays up a store of food for use in winter and spring. Its hind legs are longer than its front ones, between which it holds its food. The chipmunk or ground squirrel is so called because, though it can climb trees very well, it does not live in them, but makes its nest in burrows deep under the ground. It has large cheek-pouches, in which it carries its food to its underground store-houses. It is a beautiful striped animal, and is common in North America, where it is also called the chipping squirrel.

Stag. [Scand.] The male of the red deer of Europe. Its horns are long and branching, and when of full growth will often weigh twenty-four pounds. When the horns carry twelve points or tines the stag is a *royal* one. There are antlers in existence with many more points than this, one in Saxony having 66 points.

Stalac'tite. [Gk., to drop.] A stalk of lime hanging from a limestone cave. It is due to water carrying lime which makes its way through the cave roof, and evaporates, leaving the lime hanging like an icicle. *Stalagmite* is the stalk of lime on the floor of the cave which has dropped in water from the roof.

Sta'men. [L., a thread.] One of the thread-like pollen-bearing stalks in the centre of a flower.

Star. [AS.] One of the bright bodies seen in the sky at night, whose distance is so great that as seen from the earth they appear only as points of light. By astronomers the stars are looked upon as the suns of remote systems. Like our sun, they emit light; and when the spectroscope is applied to the light which they give out, it is found that the materials of which the stars are composed agree with those known to be present in the sun and in our earth. The distance of the stars is so great that when viewed from the earth they are always seen in the same direction; hence, as they maintain an invariable position relative to each other, they have been named *fixed stars*. This term is used in a comparative and not an absolute sense, as it is known that many of them are in a state of motion, although it can be perceived only by delicate observations. They are divided into classes, according to their apparent brightness. These are termed magnitudes. The brightest stars are said to be of the first magnitude, those that fall short of this of the second, and so on. Down to the sixth or seventh magnitude the stars are visible to the naked eye, and from the eighth to the sixteenth by powerful telescopes. The three or four brightest classes are distributed with tolerable uniformity over the celestial sphere; but of the total amount visible to the naked eye and by means of the telescope, by far the larger number are in or near the Milky Way. In certain parts of the heavens the stars are collected into groups in a more condensed manner than in neighboring parts. Such groups are called *clusters*. One well-known group is called the Pleiades, in which six or seven stars may be noticed by the naked eye, but which photography has shown to consist of 2,326. Many nebulae that were formerly thought to be masses of glowing gas have been recently found to be

clusters of stars so remote that their individual members are imperceptible except with instruments of great power. Photography has revealed stars so far distant that a message sent 1,900 years ago would only have just reached them, and would be still on the way to others, going with the speed of light, or 186,000 miles a second.

Starch. [AS.] One of the main constituents of plants. It is composed of carbon, oxygen, and hydrogen, the last two in the proportions required to form water. It is near to sugar in chemical composition and is converted into it in the life history of the plant. Wood fibre belongs



POTATO STARCH CORPUSCLES.

to the same class of compounds. These make up the great bulk of the plant, the remainder being its oily matter and its nitrogenous substance, which forms the protoplasm of its cells. Starch for commercial use is chiefly obtained from wheat, maize, rice, and potatoes; and in France from horse chestnuts. Starch in maize is from 60 to 80 per cent.; wheat, 60; rye, 60; oats, 46; barley, 57; rice, 61; potatoes, 61. Starch is found in the form of little grains contained in the cells of plants. It is insoluble in cold water; but in hot water the grains swell up until they burst and form a jelly-like mass. Corn starch is made in the United States by soaking Indian corn in water containing caustic soda and hydrochloric acid to dissolve the gluten, grinding, washing on sieves, and finishing by various processes. Rice starch is largely made in England, France, and Belgium. Starch is useful for stiffening cloths, sizing paper, making paste, dextrine, glucose, detecting iodine, and as an article of food. (See *Rice*, *Sago*.)

Star-fish. A star-shaped sea animal which creeps over rocks and sand, feeding on mussels and shell-fish. The five rays are made of limestone plates, joined by a tough membrane. Under each ray

is a groove with hundreds of tiny transparent tubes moving separately. The tubes act as feet and carry the animal forward. When the starfish feeds, it not only bends its rays into a cup shape to hold its prey, but numerous tiny suckers spring up to help. Star-fishes have a liver and intestines, and these organs extend into the five rays. They have nerves which end in a red eyespeck at the end of each ray. They do great damage to oyster beds, as they eat the oysters, which they force to open their shells. They are dredged from the beds and used as manure.

Star'ling. [AS.] A small greenish-black British song-bird, which can be taught to whistle tunes and sometimes to speak a few words. It builds in church steeples, in ruins, or on rocks. The food of the starling consists of insects, caterpillars, worms, and snails; but it also feeds on grain, fruits, and seeds. In severe winters it frequents the sea-shore, but in summer it is found in the farmers' garden, where it makes harsh cries and chattering sounds before retiring to rest. In America, bobolinks, cow birds, meadow-larks, orioles, and red-winged blackbirds are all starlings. The bobolink is black and white. The oriole is called a hanging bird because of its peculiar nest, which is like a pouch or pocket.

Steam. [AS.] Water in the gaseous state. The clouds of vapor which are seen to issue from a kettle of boiling water are also popularly called "steam;" but these white clouds consist chiefly of condensed steam, and do not possess the properties which belong to steam considered as a gas. Dry steam is as much invisible as atmospheric air. Owing to the great pressure which it exerts, to the large amount of heat which it can carry, and to the ease with which it can be condensed, steam has been found better fitted than any other gas for use in engines employed for the production of mechanical work.

Steam-engine. An engine worked by steam. The chief parts are the piston, cylinder, and valve gear. The piston works in a cylinder, to which steam is admitted by the action of the valve gear, causing the piston to move backward and forward and communicate motion to the machinery. The atmospheric engine constructed by Newcomen near the beginning of the eighteenth century was the first in which a beam was made to oscillate by the elastic force of steam. It was used for pumping water out of mines. The condensation of the steam in the space below the piston produced a vacuum, and the piston was forced down by the pressure of the atmosphere. One of Watt's first improvements was the introduction of a separate chamber for the condensation of the steam. Another improvement introduced by Watt was *double action*. By this arrangement the steam was introduced alternately above and below the piston. This consisted in cutting off the steam from the boiler before the piston had reached the top of the cylinder. It need scarcely be said that many later improvements have been introduced in the steam-engine, greatly increasing its powers.

Steam=turbine. A new form of steam motor, in which the steam is thrown against the valves of a turbine-wheel, which it causes to turn with great rapidity. These machines develop great power in small space. They have been placed in torpedo boats, driving them through the water at the unequalled speed of over 35 knots an hour.

Ste'arin. [Gk. *stear*, tallow.] A constituent of animal fats, as beef and mutton suet; and some vegetable fats as of cocoa. It is remarkable for its solidity, and raises the melting-point of fat. It is prepared by mixing ether with suet, and is used in making soap.

Steel. [AS.] A hard metal made by heating iron with charcoal. Steel is the form of iron in which the amount of carbon is intermediate between that contained in cast iron and in wrought iron. In steel, the carbon is either chemically united with the metal or dissolved in it. It may contain silicon and manganese in small quantities, but sulphur or phosphorus is regarded as an impurity. It is malleable and ductile, fusible, and capable of acquiring, by being tempered, great hardness, which renders it suitable for cutlery and the different varieties of cutting tools. Steel was at one time always prepared from wrought iron by heating the bars for some time in contact with charcoal. This method of preparation is known as *cementation*. The process of manufacturing steel known as the Bessemer or pneumatic process is of very great industrial importance. It consists in blowing air through molten pig iron in a vessel called the converter. The carbon and the silicon which the pig iron contains are thus oxidized, and the iron is brought to the condition of wrought iron. After the iron is completely deprived of carbon, a certain quantity of pure cast iron is added in order to supply the carbon necessary to convert it into steel. The metal is then cast into ingots. This kind of steel is used for railway axles and rails, for boiler plates, and for ships. Large buildings, as churches, colleges, and schools, are now made with frame-work of steel. The walls are double, and the air between acts as a non-conductor of heat.

Sten'cil. A thin plate of metal or other material with letters or a pattern cut through it. It is laid flat on a surface, a brush dipped in paint or ink rubbed over it, and the letters or pattern thus transferred. Stencils are much used by merchants to mark boxes or barrels.

Steppe. The vast, low plains of Europe and Asia, extending from Holland to Russia and thence through Siberia and Mongolia. The name is specially applied to the broad and largely arid pasture lands north and east of the Caspian, and the Siberian lowlands.

Ste'reoscope. [Gk.] An optical instrument of magnifying-glasses, with a slide for two slightly different pictures of the same thing, which when looked through throws both pictures into one, and gives the figures the appearance of solidity.

Ste'reotype. [Gk.] A metal plate, being an exact copy in a solid form of a page of type. Stereotyping by plaster of Paris was discovered by Ged in the eighteenth century. Electrotypes

have now taken the place of stereotypes in book-work. In newspaper offices, where speed is important, the paper process of stereotyping is still much used. In this process the type is placed under a press, and a matrix is made of damp paper by forcing the type into the paper. After the paper is dry type-metal is poured over it, and the metal plates are trimmed and planed.

Stethoscope. [Gk.] A medical tube used for listening to the beating of the heart or the sound of the lungs in breathing.

Stickleback. [AS.] A very small fish with two or more prickles on its back. It builds a nest somewhat like that of a bird. The male gathers weeds and erects a barrel-shaped house. He secretes in his body a sticky slime, which as soon as it touches water grows firm and hard, and with this he cements the nest. There is a hole right through the nest, so that the water flows over the eggs. In times of danger the father opens his mouth, and the whole swarm of young fishes rush in for protection. Sticklebacks inhabit both salt and brackish water.

Sting. [AS.] The sharp point with which bees, wasps, etc., defend themselves. The sting of a female bee is a dart with barbs at the end of the abdomen connected with a poison gland; and the sting is sometimes used in different bees for boring, cutting, and sawing holes in which to place the eggs. Male bees have no stings, and are harmless. When the bee leaves the sting in the wound it dies. The wasp saves her sting after inflicting a wound. The sting-ray has one or more large sharp barbed dorsal spines on its whip-like tail. The stings of nettles are hairs with a poisonous secretion.

Stone. [AS.] A piece of rock, or the hard centre of fleshy fruits. *Building stones* are natural or artificial. Natural stones are chiefly granite, marble, limestones, sandstones, and also slates. The hard stones are generally got by blasting, others by channeling and wedging, while the more fragile are sawn out in the quarries. Large masses of stone are called *rock*, smaller pieces *stone*, and finer pieces *gravel*, or still finer *grains of sand*. *Precious stones* include diamonds (*q. v.*), emeralds and beryls, sapphires (*q. v.*), and rubies (*q. v.*), amethysts, serpentine, malachite (*q. v.*), turquoise, jasper, jade, and chalcedony.

Stone-age. The era of primitive man, when his only tools and weapons were made of stone. In the *old stone-age* rudely chipped stone implements were used; in the *new stone-age* the implements were smoothed and polished. Great numbers of these stone utensils have been found, in all parts of the earth. The stone-age was followed by the bronze-age, and that by the iron-age.

Stone-ware. A coarse stuff used by potters, and the vessels of it glazed and baked.

Stork. [AS.] A wading bird of the family Ciconiidae, nearly allied to the heron, with long slender legs and rather thick neck. The bill is as long as the head, and tapers to a point. In Holland, storks give up their aquatic habits and nest on tall trees, towers, or chimneys. Some-

times frames or false chimneys are made on the tops of houses for storks to build on. The nest is built of sticks and dry grass, and there are three or four bluish-white eggs, which take thirty days to hatch. The storks feed on garbage, snakes, frogs, rats, mice, and vermin. In winter they migrate to warmer regions. Before starting on their flight they assemble in large flocks of two or three thousand, and the common belief is that they consult as to their journey. When they return to Holland in spring, they are welcomed as harbingers of that season. The white stork is found in Europe; the black stork in Europe, Asia, and Africa; the black-necked stork is the East Indian jabiru.

Stove. [Du.] A kind of box, generally made of iron, which stands in some part of the room, supplied with fuel from time to time through a door. Stoves are more economical than grates, since less of the heat produced goes up the chimney, but they are not so healthful. Anthracite requires a stove with a base burner, that causes a smaller draft of air, much in use in the United States. Oil and gas stoves are much in use for heating, and gas stoves are coming into large use for cooking purposes.

Straw. [AS.] The stalks or stems of wheat, rye, and other cereal grasses, after the grain has been thrashed. It is woven into hats, and made into boards and paper. Chip hats are not made out of straw, but from splints of Lombardy poplar.

Strawberry. A widely cultivated perennial plant, having a red, small berry, with delicious taste. In cultivation its runners spread along the ground. The flowers have five petals, and are mostly white, seated on a convex receptacle, which enlarges in the fruiting season, and becomes pulpy and edible; so that what is popularly called the fruit is only the end of the flower stem greatly altered, and bearing the real fruit in the ripened ovaries over its surface, or sunk in the succulent mass. There are many varieties. *Fragaria vesca* is the European kind, and *Fragaria Virginica* the American. The fruit has been enormously increased in size by cultivation.

Strychnine. [L., from Gk. *strychnos*, nightshade.] A strong poison got from the seeds of *nux vomica*. It is obtained as a white crystalline substance, and has a bitter, acrid taste. It is insoluble in water, but dissolves in alcohol. In medicine it is used as a stimulant for the nerves.

Stucco. [Ital., from a Ger. root of *stück*, a piece.] A kind of plaster made of lime, sand, and finely-crushed marble, for ornamenting walls.

Sturgeon. [Old Fr.] A long, narrow fresh-water fish, the roe of which is made into caviare, and the air-bladder into isinglass. It has free gills, and its body is more or less covered with bony plates, in five longitudinal rows. The tail is heterocercal, having the vertebræ continued into the upper lobe, which is longer than the lower one, and the skeleton cartilaginous. It runs up rivers to spawn. The eggs sometimes make up nearly one-third of the fish, and there are over three million in one female. Sturgeons are

found in Europe and America, and in one season 200 tons of caviare have been made on the Caspian. It is now made largely on the Delaware.

Suck'er. A fish of the carp family, many kinds of which are found in the rivers and lakes of the United States. It has no teeth, its lips being formed for sucking. It is found in the rivers in early spring, and is caught in dip-nets. The *buffalo sucker* of the Mississippi is sometimes more than a yard long.

Sug'ar. [Fr. from Arab.] The sweet juice of the sugar-cane and other plants pressed out and dried. It is soluble in water, generally crystallizable, neutral to vegetable colors, and is an organic chemical compound of carbon, hydrogen and oxygen. There are two distinct sugars—saccharoses or sucroses, and glucoses (*q. v.*) or amyloids. The saccharoses include cane-sugar, beet, palm, sorghum, and maple sugar. The first two yield nearly the whole sugar-crop of the world. The cane-sugar comes from the tropics, that of the beetroot from the north temperate zone, very largely from Germany. After sugar is boiled and strained and purified by adding lime, and filtering through cotton and charcoal, it is poured into molds, and when cool forms loaf-sugar. The liquid which remains after the sugar crystallizes, is called molasses, it being a dark, sweet, sticky liquid, much used in cooking. Glucose or grape-sugar is made from starch by the action of heat and acids. Much of it is produced from maize, being largely sold as the glucose sirup.

Sulphur. [L.] A yellow mineral, occurring in large quantities either as pyrites (sulphides), gypsum (sulphates), or native, mixed with gypsum. It is found in volcanic regions. It is purified by distillation, and is obtained by sublimation as a lemon-yellow powder (flowers of sulphur) or as sticks (brimstone). It burns with a blue flame and a peculiar irritating odor. It is used in gunpowder, and in making matches, in medicine, and in making sulphuric acid. Sulphur is also obtained as crystals.—*Sulphuric acid*, the most important compound of sulphur and oxygen, is a heavy, corrosive oily liquid, colorless when pure, but usually of a brownish color. It is used in the manufacture of hydrochloric and nitric acids, alizarin, soda, and bleaching-powders; in making ether, parchment, and nitro-glycerine, and in etching iron. It was formerly called vitriolic acid, and is popularly called *vitriol* or oil of vitriol. (See *Epsom Salts*.)

Su'mach. A genus of small trees and shrubs, having numerous species, found in all parts of the world except Australia and the polar regions. The leaves of a kind grown in America are used by the Indians for tobacco. The seeds of another kind yield Japan wax or varnish. Chinese galls come from another species, and are largely used in tanning and dyeing. There are twelve kinds in the United States, and two of them are poisonous. These are the poison ivy and the swamp sumach, which cause a skin eruption, attended with violent itching. The Virginian or

stag's-horn sumach is a common American species. The leaves are pinnate, the flowers in a crowded panicle, and the fruit globular, covered with hairs. Their scarlet leaves in autumn are conspicuous forest ornaments in America.

Sun. [AS.] The body in the heavens that gives light and heat, and round which the earth and planets revolve. (See *Solar System*.) It is about



92½ million miles distant from the earth, and its diameter is about 860,000 miles. It revolves on its own axis once in 25½ days. Its luminous surface is called the photosphere, above which is an envelope largely of hydrogen, called the chromosphere, visible through the spectroscope, or at the time of a total solar eclipse. Above the chromosphere, and extending for millions of miles, are rays of light called the corona. Dark spots appear on the sun's disc, and consist commonly of a black central portion with a surrounding border of lighter shade. These change in their size from points to spaces 50,000 miles in diameter. It has been established that a maximum and a minimum number of sun spots occur in periods of 11 years. The sun is not a fixed body, round which the earth and other planets circulate, but it, with all the planets, has a motion through space. In regard to *physical structure*, the sun is believed to be a mass of incandescent (glowing hot) gases, the temperature of which is so high that none of the chemical elements entering into its composition can exist in any other than the gaseous state. The quantity of heat given off by the sun is enormous. There are several theories as to its origin, the most probable being that it is due to a gradual shrinkage of the sun's mass which reduces its power of containing heat.

Sun=dial. An apparatus in common use as a time-keeper when clocks and watches were scarce and costly. It consisted of an upright style whose

shadow was thrown by the sun on a plate of metal. As the day went on the shadow moved over the marks on the dial, indicating the hours and their divisions.

Sun-fish. A genus of fishes with short, rounded, and flattened bodies. There are small species in many streams, and the great sunfish of the Atlantic grows to the length of 4 feet and the weight of over 500 pounds.

Sunflower. A tall plant, a native of America, having large marginal ray flowers with yellow rings. The seeds are used as food for cattle and poultry, and yield an excellent oil. The flowers abound in honey, and the leaves are useful as fodder. One of the tuberous species is the Jerusalem artichoke.

Swallow. [AS.] A small bird, with small legs and weak feet, but with long, pointed wings and a forked tail, which are both favorable to swift flying. It flies at a rate of from 60 to 90 miles an hour, and delights in circling round places where insects abound, upon which it feeds. The



house-martin or town swallow fixes its mud nest under the eaves of houses. The sand-martin with its tiny beak bores holes in sandstone rocks, where it makes its nest at the farthest extremity with loose hay and a few goose feathers. There are a number of American species, a common one being the barn-swallow. The nest of the esculent swallow, which inhabits Ceylon and Sumatra, is much valued by the Chinese. It consists of seaweed, which the birds swallow and mix with their saliva, and then deposit in layers round their nests, and the whole is hardened by the air. The nests are glued on rocks or inside caverns, near the sea-shore. When boiled, these nests, which are in reality a fine gelatine, yield a good quality of glue or jelly, which is made into soup. (See *Swift*.)

Swan. [AS.] The largest and most graceful of all swimming birds. When full-grown its feathers are white, but when young they are bluish-gray. Its feathers are thick and oily, and cast off water. Its feet are webbed, and it swims rapidly. Its legs are placed far back, and this gives it a waddling walk. Its neck is longer than its legs, and so it can reach its food. It feeds on roots and

seeds of water-plants, and is fond of worms, small fishes, and snails. Its nest is built of grass and reeds on the banks of rivers or lakes. The swan is found all over the world, and being beautiful on the water, is when tame kept on ponds and ornamental waters. The black swan of Australia has a red bill crossed with a white band. The South American black-necked swan has a bright rose-colored double knob on its bill.

Sweet-bread. Part of the inside of an animal, with a sweet taste and a likeness to bread, used as food. The thymus gland is called neck or throat sweet-bread, and the pancreas the belly sweet-bread.

Sweet Flag. A kind of reed which flourishes along the banks of rivers or grows in swamps and ponds. It is found in the cooler sections of Europe and North America, also in some parts of Asia. Confectioners use its roots, which have a strong smell and a biting taste, in making some kinds of candy.

Sweet-pea. An annual plant, *Lathyrus odoratus*, or its many-colored sweet-scented blossoms.

Sweet-potato. A plant which is not allied to the white potato, but belongs to the morning-glory family. It is a creeping vine, bearing long root tubers of sweet taste. It was probably of American origin, but is now widely cultivated. Many tropical varieties are known as yams. It needs a warmer climate than the Irish potato, and does not do well in Europe, but is widely grown in the United States, many millions of bushels being raised annually.

Sweet-will'iam. A kind of pink of many different colors and varieties.

Swift. [AS.] A quickly-flying bird of the Swallow family. Its form and habits resemble those of the swallow. It has a shorter bill, but it has no complex vocal muscles. It nests in church steeples and under the tiles of roofs, and screams shrilly. The Australian and American swifts have rigid tips to the tail feathers. The American chimney-swallow is a swift which has acquired the habit of building in chimneys, fastening its nest, which is made of small twigs, to the wall by a strongly adhesive secretion. This glue is spread over the whole nest, and becomes very hard.

Sword-fish. A large fish with the upper jaw long and pointed like a sword, which pierces four or five inches of solid wood. Its dorsal fin is high, and ventral fins are absent. It swims very fast, and is one of the deadliest enemies of the whale, which protects itself by diving to the bottom of the sea, whither the sword fish cannot follow. It is plentiful on the coasts of Massachusetts, where it is caught by the harpoon, and its flesh, though coarse, is eaten.

Sycamore. [Gk.] A kind of fig-tree in Egypt and Syria; the great maple in Europe and the plane tree in America.

Syr'inge. [Gk.] A tube fitted with a piston for sucking up and squirting out water and other liquids, used for injecting them into wounds or openings of the animal body, or in gardens for throwing liquids upon plants.

T

Tack. [Celt.] A small nail with a broad, flat head; also the direction of a ship in regard to the trim of her sails—the starboard tack when close hauled with the wind on her starboard side, the port tack when on the port side. In tacking or changing the direction, a vessel is brought to point at first directly to windward, and then so that the wind will blow against the other side.

Tack'le. [Scand.] Ropes and pulleys for lifting weights. *Ground-tackle* are anchors, cables, etc.; *gun-tackle*, the apparatus for hoisting cannon.

Tad'pole. A frog (*q. v.*) in its youngest state. In this stage it breathes by means of external or internal gills, and has a fin-like tail.

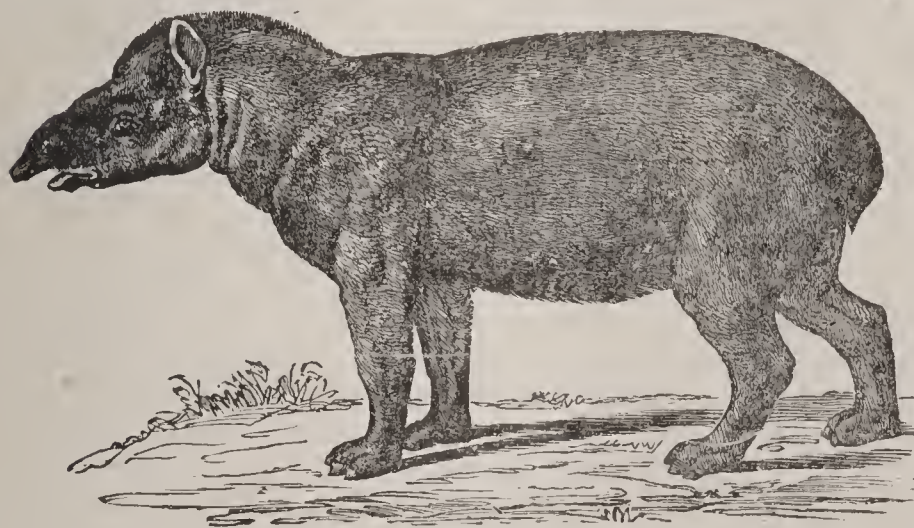
Tail. [AS.] The long flexible part of an animal that terminates its body behind. It contains a series of movable vertebræ, and is covered with flesh and hairs or scales. The tail of birds consists of fused vertebræ; the tail of fishes ends in a caudal fin. Woodpeckers climb and rest on the stems of trees with their tail feathers.

Tail'or-bird. An Asiatic or East Indian bird that makes its nest by sewing together the leaves of trees, and in doing so uses its beak and claws instead of a needle.

Tal'low. [AS. or Scand. *talgr.*] The fat of animals of the ox or sheep kind. Its solidity is due to the large amount of stearin it contains. It is used to make candles (*q. v.*).—The *Tallow-tree* grows in China, and produces from its seeds a substance resembling tallow.

Tam'arind. [Arab.] A lofty, wide-spreading tree in the Indies, with flowers in racemes, pinnate leaves, and pods abounding in acid pulp of cooling and laxative qualities. West Indian tamarinds are preserved in sirup, but East Indian fruits are put up without sirup.

Tam'arisk. [L. *tamariscus.*] A tree or shrub



TAPIR.

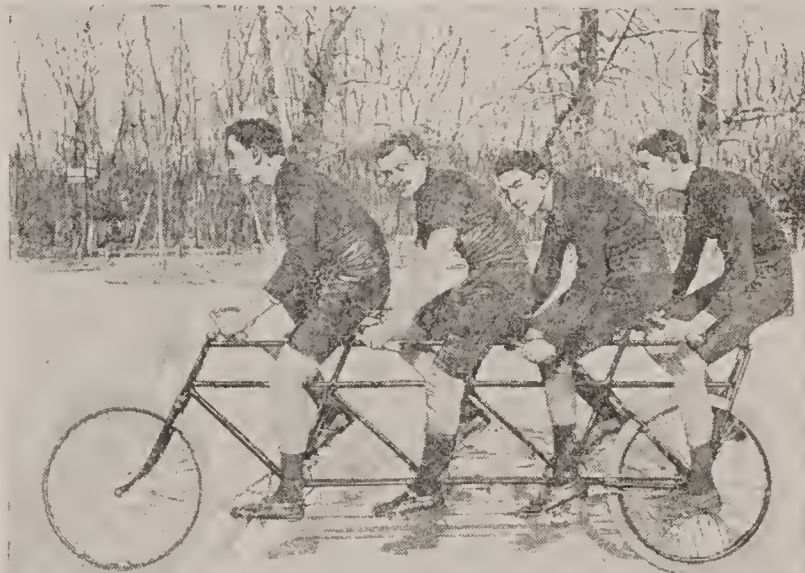
with small scale-like leaves and clusters of white or pink flowers. Its bark is used as an astringent, and the ashes of the plant yield sulphate of soda.

Tam'bourine. A musical instrument consisting of a piece of parchment stretched on the top of a hoop, furnished with little bells. In play it is struck by the hand or elbow, and the bells jingled.

Tan'ager. A group of American birds conspicuous for their brilliant colors. They represent the

finches of Europe and Asia. The most beautiful of them, the scarlet tanager, comes from Mexico to the United States in April, its range extending to Canada. The male is of a bright scarlet.

Tandem. A Latin word meaning at length. Ap-



plied to horses driven one in front of the other. A bicycle carrying two, three or four persons.

Tan'nic A'cid. Acid derived from *tannin*, which is the astringent principle of oak-bark or gall-nuts, and is used in tanning and as an astringent. It is the basis of common ink. It is sometimes used to describe all astringent substances in the vegetable kingdom—in willow, tea, coffee, etc.

Tan'ning. [Fr. *tanner*, from Armorican *tann*, oak-bark.] The turning of skins into leather (*q. v.*) by steeping in water mixed with oak-bark.

Tape. [AS., from L. *tapete*, cloth for hangings.] A narrow woven band used for tying and binding.—*Tape-worm*, a long, flat, parasitical worm, with small head, no mouth, but having suckers and sometimes hooks for adhesion to the walls of the intestines. The pork thread-worm from pigs, the beef tape-worm from young cattle, and the broad tape-worm are parasites of man.

Tap'etry. [Fr. *tapisserie.*] Cloth of wool and silk, covered with woven or sewed figures, for hanging on walls. Tapestry carpet resembles Brussels carpet in having the colors of the warp printed before weaving.

Tapio'ca. [Braz.] A granular substance got by heating the manioc root. The manioc or cassava root is bitter, and has a poisonous sap, which by grating, pressing, and baking is lost. It is grown in the West Indies and in Africa. Tapioca is much used in puddings and as a thickening for soups.

Ta'pir. [Braz.] An animal with a thick skin, short ears, short neck, and long prehensile upper lip. It is between three and four feet high and from five to six feet long, and in general form reminds us of the hog. The tapir has three toes on the hind feet and four toes on the fore feet, but the outermost toe is of very little use. Its long nose is like a rudiment of the elephant's

trunk. There are two kinds of tapirs: one, a native of South America, is of a dusky-brown color; the other lives in Sumatra and Java, and is black, with a broad white band across the body. Tapirs are harmless, gentle creatures, but they can give a severe bite with their big teeth when attacked. They have great strength and can force their way through the thick underwood of tropical forests to the water, of which they are very fond.

Tar. [AS.] A black, sticky liquid, distilled from pine trees and from coal. When charcoal is produced, an arrangement is made for collecting tar. From wood-tar is distilled wood-vinegar or pyroligneous acid, from which is produced wood-naphtha. Wood-tar is got from the Scotch fir, the Siberian larch, and other fir-tree roots. Coal-tar is a product in making gas, and yields crude naphtha and pitch. Mixed with wood-naphtha, crude naphtha is a solvent of resins. Benzole, carbolic acid, and aniline colors are all obtained from coal-tar. (See *Coal-tar*.)

Taran'tula. A poisonous spider found near Tarentum, in South Italy; others are found in Texas. (See *Spider*.)

Tare. [O.E.] The vetch or tare somewhat resembles the pea. The "winter" vetch is sown in autumn, and is cut in May; spring vetches are sown in February. The vetch likes clayey or marly soil, and is cut little by little as fodder for cattle and horses, or sheep are penned upon it. The winter vetch is useful, as it comes when other forage is scarce.

Tarpau'lin or Tarpau'ling. A piece of coarse canvas covered with tar to keep out wet.

Tar'tan. Woolen cloth woven in stripes or checks, formerly much worn by Scottish Highlanders, whose clans were known by the different-colored tartans. *Trews* are trousers made of tartans.

Tea. [Chin.] The leaves of the tea-plant. The tea-plant, chiefly cultivated in China and in Assam, is a low bushy shrub, bearing a small white flower, and having leaves with saw-like edges, like those of the rose. Either black or green tea can be made from the leaves of the same plant. For *black* tea, the leaves are picked and exposed to the air in large heaps for one or two days. They are then placed on tables, and rolled by hand, and then dried or roasted in large iron pans, when their color changes to a dark, almost black, hue. For *green* tea, the leaves are dried almost as soon as picked, when they preserve much of their natural color. The dried leaves of the tea-plant contain a white crystalline substance called *thein*. When boiling water is poured on the leaves, thein, or the active principle of tea, is dissolved out. The liquid so obtained is called an "infusion." Green tea contains rather more thein than black tea, and so produces a stronger infusion. Tea is a favorite table beverage from its stimulating properties. The cultivation of this plant in the Southern United States has proved successful.

Teak. [Malabar.] A tree found in India, the East Indies, and in Africa, the wood of which is

very hard and durable. It is used in ship-building, and in the construction of buildings.

Teal. [O.E.] A small fresh-water duck. The male is handsomely colored, and has a bright green or blue patch on the wings. In America teals are valued as game birds.

Telau'tograph. A form of telegraph, invented by Prof. Elisha Gray, by which writing and drawings can be transmitted and reproduced in fac-simile.

Tel'egraph. [Gk. *tele*, far; and *graphein*, to write.] Stretched wires along which messages are sent by electricity. (See *Electric Telegraph*.) The messages are given by a pointer in the Wheatstone, by a fillet of paper in Hughes's, by dots and dashes in Morse's, and by symbols in Bain's system.

Telep'athy. [Gr. *tele*., far; *pathos*, feeling with.] The supposed transfer of thought from mind to mind without speech or other physical communication. It is claimed that the thought of one person has been recognized by another through a distance of many miles.

Tel'pherage. [Gr. *tele*., far; *pherein*, to carry.] A method of conveying goods along a suspended wire by aid of an electric motor. It has been used to carry ore from a mine and to convey logs from a forest.

Tele'phone. [Gk. *tele*, far; and *phone*, a sound.] An instrument which enables persons to talk to each other at considerable distances by electric wires. In its use a thin sheet of metal is set in

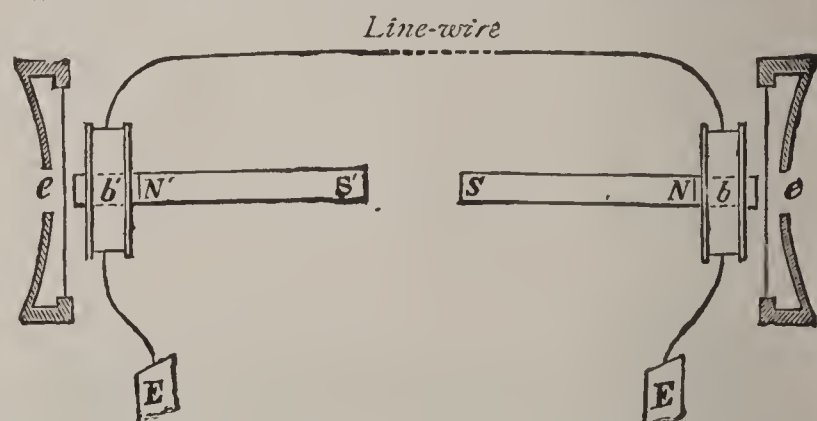


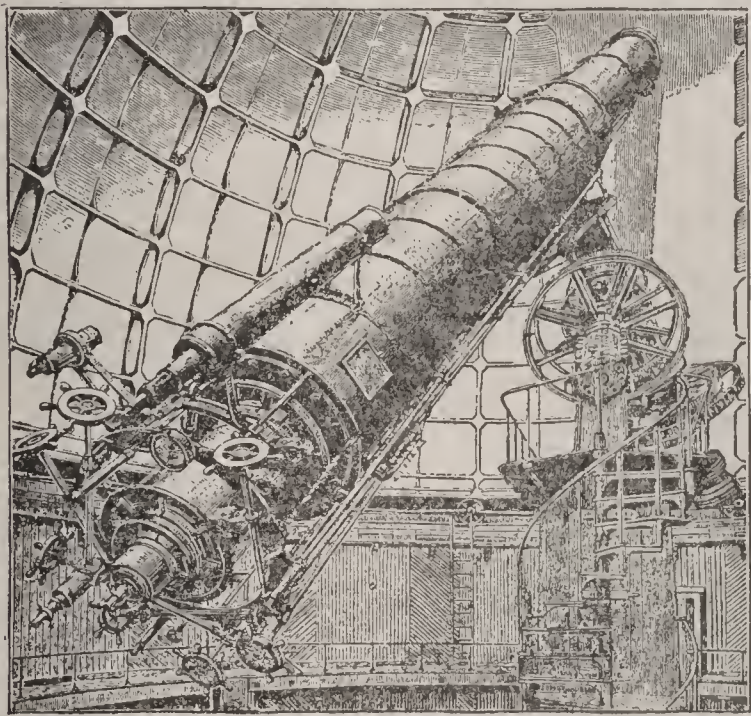
DIAGRAM OF TELEPHONE TRANSMITTER.

NS, N' S' cylindrical steel magnet surrounded at one end by a coil of wire, *bb'*, whose ends are connected by wires, with line wire and the earth, *Ee*, is mouthpiece in front of which is a very thin sheet of metal which vibrates.

vibration by the tones of a person's voice. These vibrations cause rapid alternations of strength in a current of electricity passing through a wire. At the opposite end of the circuit the varying currents act to set a second thin plate in vibration, and sounds are conveyed to the listener's ear like those of the speaker's voice. In this way the human voice can be transmitted for more than a thousand miles, and by a recent invention may soon be heard several thousand miles away.

Tel'escope. [Gk. *tele*, far; and *skopein*, to see.] An instrument consisting of a tube and magnifying glasses for seeing things at a distance. In reflecting telescopes the image is formed by one or two concave mirrors, a large one at the lower end and a small one at the upper end. Sir William Herschel's telescope contained one

mirror. In refracting telescopes the image is formed by refraction in an object-glass, and is magnified by an eye-glass. The largest refracting telescopes, made by Alvan S. Clark, are that at the Lick Observatory, Mount Hamilton, California, which has a 36-inch object-glass, and magnifies from 180 to 3,000 diameters; and the Yerkes of the Chicago University, with a 40-inch



THE LICK TELESCOPE.

object-glass and 64 feet of focal length. One of 48-inch object-glass was shown at the Paris Exposition of 1900. The Lick telescope separated the closest double stars known to us, and discovered the fifth satellite of Jupiter. Lord Rosse's telescope at Parsonstown is a reflector with 72-inch aperture. Common's reflector at Ealing is 5 feet in diameter. If the brightness of a star seen with the eye alone is one, with a 2-inch telescope it is 100 times as bright; with a 4-inch telescope it is 400 times as bright; with an 8-inch telescope it is 1,600 times as bright; with a 32-inch telescope it is 25,600 times as bright; with a 36-inch telescope it is 32,400 times as bright. That is, stars can be seen with the 36-inch telescope which are 30,000 times fainter than the faintest stars visible to the naked eye.

Tem'perature. [L.] The amount or degree of heat in any person, place, or thing; the condition which indicates whether heat will flow from one body to another, the body parting with heat being said to have a higher temperature, and the one receiving it a lower temperature than the other. In practice, temperature is measured by the expansion produced by heat in a liquid or a gas in a thermometer.

Ten'dril. [Fr. from L. *tener*, tender.] The long, slender, leafless shoot of a plant by which it clings to a support. They are the ends of stems, as in the grape vine; axillary branches in the passion flower, or ends of leaves in the pea.

Ten'tacle. [L.] A kind of arm or fleshy process attached to the head or body of some insects and other animals, by which they feel, grasp, or move.

Ter'ra-cot'ta. [L. *terra*, the earth; *cocta*, baked.] A kind of pottery or baked red clay. (See *Brick*.)

Ter'rier. [Fr. *terre*, the earth.] A small dog that burrows into holes in the earth after rabbits, rats, etc. The Skye has long hair and drooping ears. English and black and tan have short, close, smooth hair and upright ears. Fox terriers are both smooth and rough in variety.

Thatch. [AS.] A covering of straw, reeds, or rushes for roofs of buildings or stacks of hay or grain. Palm leaves are used in the West Indies for thatching.

Thermom'eter. [Gk. *thermos*, hot; and *metron*, measure.] An instrument for measuring changes of temperature by the contraction or expansion of a liquid or a gas. The three scales at present in use are—(1) the Fahrenheit, in common use in Great Britain and the United States; (2) the Centigrade, used on the Continent and in scientific works generally; (3) Reaumur's scale, used in Russia. In Fahrenheit's scale the freezing-point is marked 32°F. and the boiling-point 212°F. the intervening space containing 180°. In the Centigrade scale the space between the two points is divided into 100 equal parts—the freezing-point being marked 0° C., and the boiling point 100° C. In Reaumur's scale the freezing-point is marked 0° R., and the boiling-point 80° R., the space between the freezing and the boiling-points being divided into 80 equal parts. Since 180° on the Fahrenheit scale correspond to 100° on the Centigrade, the length of one degree Fahrenheit is 100-180th or 5-9th of one degree Centigrade, and any reading on the Fahrenheit scale is converted into the corresponding Centigrade reading by the following rule: Subtract 32 and multiply the remainder by 5-9th. When very low temperatures are required an alcohol thermometer is used, because mercury freezes at about -38° F. Air is of great use in determining temperatures above those at which mercury can be employed (mercury boils at 660° F.). Other types of thermometers are *maximum*, *minimum*, and *solar radiation* or self-registering thermometers. (See *Fahrenheit*, *Reaumur*.)

Thim'ble. (From *thumb*.) A sheild for the finger, used in sewing. It is usually made of metal, and has on the outer surface small pits to catch the head of the needle. A machine-made silver thimble takes more than 20 men to make it. The silver is rolled into strips, cut, punched, edges turned, stamped into shape, indented, polished, and engraved.

This'tle. [AS.] A plant with prickles along the stalks and leaves. There are many varieties. The cotton thistle, the musk thistle, and the bull or spear thistle are used as national emblems of Scotland. Seeds of thistles have downy fibres, and are thus easily blown about and carried great distances.

Thrush. A large family of insect-eating birds, found in nearly all parts of the world. The wood-thrush is one of the most abundant American species, and is noted for the beauty of its

song. The hermit-thrush and the mocking-bird (*q. v.*) are other American species. The brown-thrush, or thrasher, as it is called, is a handsome bird, with habits like those of the mocking-bird, which it ranks next to as a singer. The song-thrush of Europe, sometimes called the *throstle* in England and the *mavis* in Scotland, is much like the wood-thrush. The robin, the blue-bird, and the wren belong to the thrushes.

Thun'der. [AS.] The loud noise which follows lightning. The rattle of a discharge of atmospheric electricity.

Thyme. [Gk.] A pungent, sweet-smelling plant, much used to give a relish to seasoning and soups. Oil of thyme, distilled from it, is used in liniments.

Tick. A species of insect parasites which are often very annoying. They are of minute size and have the mouth shaped like a sucker. They are found in thick woods on plants, and attach themselves to any animal that passes. They attach their sucker to the skin and work their way into the flesh, sucking the blood. They multiply so fast that many horses and cattle die from exhaustion, due to loss of blood. The ox-tick, when filled with blood, is half an inch long. The water-tick, another variety, always lives in the water.

Tides. [AS.] The rising and falling of the sea, caused by the moon's action. Owing to gravity, the moon exerts an attraction on every part of the earth, whether liquid or solid, but only the liquid parts which constitute the ocean are free to yield to the attractive force. When the moon is overhead, the water is drawn outwards and heaped up on the side of the earth next the moon. The projecting portions of the water under the moon, on both sides of the earth, represent the positions of high tides, while the low tides occupy the intermediate positions, and we experience what is called high or low water, according as the higher or lower part of the wave reaches our shores. The sun as well as the moon produces tides; but owing to its greater distance, the effect produced by the sun is small in comparison with the attraction of the moon. When the sun and the moon act together we have *spring tides*; when in opposition we have *neap tides*. When the tide rushes up a narrow channel, it rises to an unusual height. In the Bay of Fundy the rise and fall is not less than fifty feet, and in the Bristol channel there is a rise of about thirty-eight feet at spring tides. In the Mediterranean the tides have only a small range, varying from one to two feet.

Ti'ger. [Gk.] A carnivorous quadruped, like the lion in all its habits, except that it roams about by day as well as by night. In color it is yellow, with black stripes across the body. Its body is longer and stronger than the lion's, but shaped more like a cat's. It has no mane. Its under part, as well as the chest and throat, are white, and so are the long hairs on each side of its face. The tail is like a cat's in shape, and has no tuft at the end. The tiger is found chiefly in India and Ceylon. Indian princes hunt it with elephants.

Tile. [AS. *tigel.*] A piece of baked clay of a curved or flat shape used in roofing houses or for drains. (See *Brick.*)

Tin. [AS.] A metal white, like silver, easily melted or beaten out. Owing to the fact that it does not tarnish either in dry or moist air, it is



TIGER.

much used for cooking-vessels, especially in the form of tin-plate. Tin is also used in the preparation of several important alloys, such as bronze, pewter, Britannia metal, bell-metal, etc. It does not occur in the native state, the tin of commerce being obtained from the dioxide, known to miners as tinstone. The chief European supply of this mineral is derived from the mines of Cornwall. It is also met with in the Malayan peninsula, the isle of Banca, and Australia. Deposits have been found in the United States, but none that paid to work. In order to prepare the metal, the tinstone is broken into fragments; and as it remains among the *debris* unchanged in character, it can, like gold, be separated from the lighter portions of rock by washing. It is then reduced to the metallic state by roasting in a furnace.—*Tin-foil*, tin beaten out very thin, like a leaf.

Tin=plate. The name given sheet-iron coated with tin. It is largely manufactured in South Wales, and of late years in the United States. The plates are dipped in acid and afterwards washed in water to insure their being perfectly clean. They are then toughened by passing them between polished rollers, coated, and passed between steel rollers. Tin-plate is used extensively in the manufacture of kitchen utensils, and for the tins required in preserving meat, fruit, and vegetables.

Tin'sel. [Fr.] A thin kind of cloth interwoven with gold or silver threads, or thin metal covered thinly with gold or silver.

Tint. [Fr.] A shade of a color. Red and black make brown; red and yellow, orange; blue, black, and red, olive; blue and lead, pearl; blue, white, and lake, purple; blue, white, and black, pearl gray; white and lake, rose; white and brown, chestnut; white and carmine, pink; white and green, bright or pea green; white and lampblack, lead; white and purple, French white;

white and yellow, straw ; white, yellow, and red, cream ; white, yellow, and Venetian red, buff ; white, lake, and vermillion, flesh color.

Tit'mouse. [O.E.] A little song bird which feeds on insects. The blue, marsh, crested, and long-tailed titmice are the best known European species. The chickadee or black-cap tit is a common American species, and the tufted tit the largest. *Tit* is the titlark ; *tomtit* is the blue titmouse or the wren.

Toad. [A.S.] A crawling animal like the frog, but without teeth, and more terrestrial in its habits. It has a thick and heavy body, covered with wart-like glands, which secrete an acid fluid. The tongue is well developed, and can be protruded rapidly to capture insects. The skin absorbs moisture, and is cast off at intervals and swallowed. The winter is spent in a torpid state in holes and crevices. Toads are long-lived, and are found all over the world. They feed on insects injurious to vegetation. Tree-toads have loud, shrill cries, and are often brightly colored. The Surinam toad of Guiana is eaten by the natives. Its eggs are not laid in water, but are received by the male, who deposits them on the back of the female, where the skin thickens between the eggs, till each is invested in a sac, in which the young go through changes, and each emerges a perfect toad.

Tobac'co. [Span., from Ind.] A plant of the Nightshade family, the leaves of which when dried are used for smoking. It was found in America—in use among the Indians—by the Spanish discoverers. The plant is four or five feet high, has a moist, hairy stem, and leaves sometimes two feet long. The leaves are arranged round a single stalk, and the flowers, which are white and shaped like a funnel, grow at the top of the plant. Only plants grown for seed are allowed to blossom. It is grown in the West Indies, in the southern United States and in other countries. Much is grown in the Philippine Islands. Tobacco leaves rolled up tightly form cigars. The leaves are also twisted, pressed into cake, or cut fine. In making chewing and smoking tobacco in the United States, the leaves are sweetened, colored, and flavored with molasses, liquorice, salt, soda, saltpetre, and aniseed. Snuff is the leaf and stalks ground into powder. Much tobacco is used in the form of cigarettes.

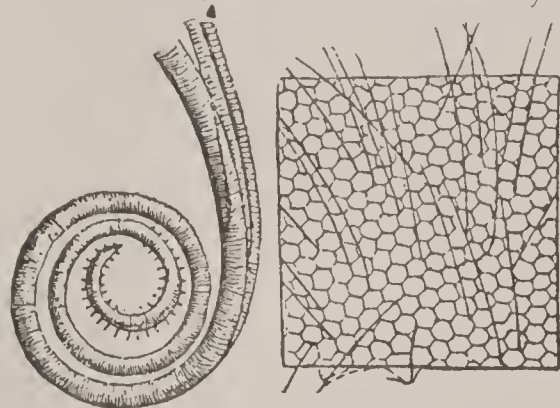
Tobog'gan. An Indian sledge, made of a piece of birch-bark, with the front end turned up, and a rope attached to drag it over the snow. This became much used by the white settlers in Canada, and is now employed in the sport of sliding down a hill of snow, or a timber slope called a *toboggan slide*. In this form it is made of hickory splints, 5 to 15 feet long.

Toma'to. [Span.] An annual plant of the Nightshade family ; also its fruit, which was formerly called *love apple*. It is of a red or yellow color. The tomato is of South American origin, but is now an important article of diet in the United States, England, France, and Italy. Its stem is weak, its leaves irregular, and both are clothed with

hairs of a resinous substance. It has yellow flowers, and its fruit requires a high temperature to ripen.

Tongue. [A.S.] The fleshy movable organ of the mouth, used to taste or speak. In some insects, as the butterfly, it is a very curious organ.

Tooth. [A.S.] A small, hard body in the jaws, used for biting and chewing food. Like the nails and hair, teeth may really be considered as



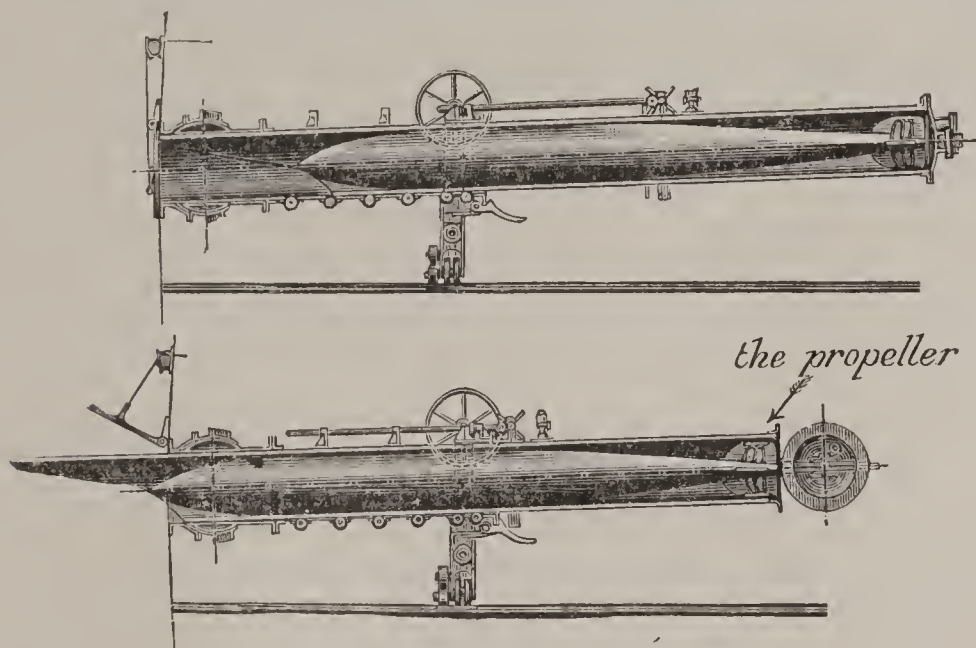
TONGUE AND EYE OF BUTTERFLY.

portions of the skin made compact and dense by the deposit of various mineral substances. Man has *two* sets of teeth ; the first set, the milk-teeth or temporary teeth, are twenty in number. They

are got when two years old. At six years the permanent teeth, growing up from beneath the milk-teeth, push the latter out, and at ten all the temporary teeth have been replaced by permanent teeth, altogether thirty-two in number—sixteen being placed in the upper, and sixteen in the lower jaw. Teeth are of different shapes, because some are intended for one purpose, and some for another. The part of the tooth imbedded in the gum is called the *fang*, while that above the gum is known as the *crown* ; the crown of each tooth is overlaid with a pearly-white enamel. The eight teeth in the front of the mouth—four in the upper, and four in the lower jaw—have sharp cutting edges like chisels, and are called *incisors* ; they are useful for biting or separating food. One on each side above and below are the four *canine teeth* or eye-teeth, called *canine* because they are so large and prominent in the dog (Latin *canis*, a dog), and also in all beasts of prey. These canine teeth are useful for *tearing* and for biting the food. Farther back in the jaws are eight teeth (two on each side above and below) called *pre-molars*, because they are next to the *molars*, twelve large teeth which occupy the hinder parts of the jaws. Both molars and pre-molars are mainly useful in *grinding* the food ; whence their name, from the Latin word *mola*, a mill. The four last molars at the ends of the jaws are called the “wisdom teeth,” because they are the last to be cut, usually not making their way through the gum till the age of twenty one. The teeth are not perfectly solid. Inside of each tooth there is a little hollow called the pulp-cavity, which contains several nerve-branches. These nerves pass along each fang into the gum, and are there connected with other nerves which go to the brain. When from any cause the enamel of the tooth is worn away, the delicate contents of the pulp cavity are exposed to the air, and to pressure from any little hard bits of food which may get inside the hollow place. Cold or pressure on the nerves produces the intense pain called toothache.

To'paz. A mineral ranked among the precious stones. It is found in Scotland, Cornwall, Saxony, Siberia, the United States, Mexico, and Brazil. The finest varieties are found in Brazil and the Ural Mountains, and are of a deep yellow tint, while those of Siberia are blue, the other colors found being white and green. They are frequently found in the cavities of granite rocks, and consist of a silicate of alumina in which fluorine takes the place of oxygen. It is next to the sapphire in hardness. The topaz of the ancients, obtained from *Topazos*, an island in the Red Sea, was *chrysolite*.

Torpe'do. [L.] A kind of fish related to the rays, with the power of giving an electric shock; also an explosive below the water to explode an



SELF-PROPELLING TORPEDO.

enemy's ship when touched or fired by electricity, or a sub-marine boat carrying the explosive.

Torpe'do boat. A recent form of naval vessel used to discharge torpedoes against a hostile vessel for the purpose of destroying it. These vessels are small and very swift, some of them making over 30 knots an hour. As yet they have not proved very serviceable in naval warfare.

Tor'toise. [Fr., from L. *tortus*, twisted.] A creeping and swimming animal (so called from its *crooked* feet) covered with a hard shell, with openings for the head, legs, and tail. The tortoise is also called *turtle*, but this name is sometimes restricted to the marine species, *tortoise* to the land species, and *terrapin* to fresh-water species. Tortoises are mostly used for food; and the green turtle, a marine animal, is extensively used for soup. The common box tortoise is more thoroughly protected than ordinary turtles, because it has joints at the bottom of the shell, and can draw up the under parts all round the edge of the box.—*Tortoise-shell.* The shell of the hawk's-bill turtle, separated into thin plates, softened in hot water, and shaped in molds, in which it may be impressed with ornamental figures. It is used for combs, knife-handles, etc.

Tou'can. [Braz.] A fruit-eating bird, with a very large but light and thin beak, often as long as the body of the bird. It is brightly colored.

Tour'maline. A mineral found frequently in granite, gneiss, and mica schist. Some varieties are more or less transparent, others opaque. The transparent colored kinds are used as jewels, and prisms of tourmaline are used in experiments on the polarization of light.

Tow'er. [Fr. from L. *Tunis*.] A building of considerable height used for observations or for architectural effect. *Gay-Lussac's* and *Glover's towers* are used in making sulphuric acid. *The Tower of London* is famous in history as a State Prison. *The Leaning Tower of Pisa*, Italy, is 180 feet high, and is 14 feet out of perpendicular. *The Eiffel Tower*, Paris, is 985 feet high and built in 1889.

Trade-winds. Persistent winds which rise in the torrid and lower temperate zones and blow steadily towards the equator, being deflected westwardly by the earth's rotation, so that they become northeast or southeast winds, as they are north or south of the equator. They are caused by the ascent of heated air in the equatorial region, and the inflow of colder air to take its place. The ascending air outflows to the north and south and gradually descends to the surface, making what are known as *anti-trade* winds. The trades diverge to the north or south as the sun does so in its annual round.

Tram'way. [E. *tram*, a bar; and *way*.] The English term for a street railway; a road laid with beams or rails, on which wagons or carriages can run easily.

Trans'it Instrument. An instrument for detecting the time of transit of a star across the meridian. It consists of a telescope mounted on a horizontal axis.

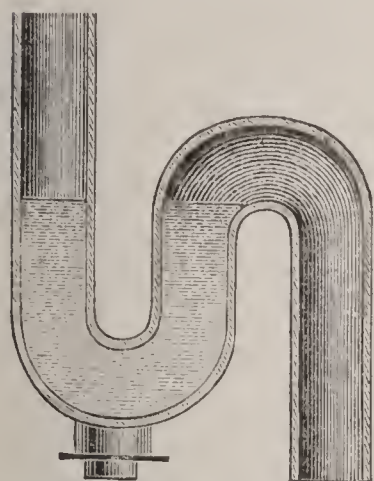
Trap. [AS.] A contrivance to prevent the passage



THE LEANING TOWER OF PISA.

of offensive gases along a drain. The siphon trap, which is perhaps the best and simplest, is merely a bend in the pipe, which remains filled with

water. There ought to be traps placed where the pipes from the inside of the house join the drain, and there should also be a trap just where the



TRAP.

drain joins the sewer. But drains and sewers ought both to be *ventilated*—to have openings for the bad gases to escape.

Trapeze'. [Gk.] A swinging bar, hung from a roof, on which athletes perform.

Trawl. [Fr.] A net like a bag used for catching fish. It is attached to a beam with iron frames at its end, and is dragged at the bottom of the sea.

Trea'cle. [Fr., from Gk. *theriaka*, drugs for healing the bites of wild beasts.] Molasses drained from sugar-refining molds.

Tre'foil. [Fr., from L. *tres*, three; and *folium*, leaf.] A three-leaved ornament, like the three-leaved clover.

Trel'lis. [Fr., from L. *trichila*, an arbor.] A kind of network made by crossing strips of wood or iron, for supporting climbing plants, or as a screen.

Tre'pan. To take out a portion of the skull in case of injury to the head or disease of the brain. This is done by means of a small circular saw, which cuts out a round piece of the bone. In healing, the bone throws out granulations, which gradually ossify, but do not quite close up the opening.

Trichi'na. A minute worm which infests the intestinal canal of certain animals, including man and the hog. This is in the adult procreative state. The young, larval trichinæ bury themselves in the muscles, where they exist as spirally-coiled worms in minute cysts. Their danger to man is in their immense numbers. In a cat, a single ounce of flesh was



estimated to contain 325,000 trichinæ. They enter man principally through partly cooked pork. Thorough cooking destroys them and obviates the danger of infection.

Tri'cycle. [Gk.] A vehicle with three wheels, one or more of which are turned by the feet by means of pedals.

Trout. [AS., from Gk. *trogein*, to eat.] A beautiful silvery fresh-water fish of the genus *Salmo*, very much prized for food, and a favorite fish for anglers. The most important are the brown-trout and the salmon-trout. Its habits are solitary and very predaceous. It feeds upon worms, minnows, insects, and caterpillars. The minnow is the most taking bait for large trout. The trout is found in lakes and rivers, but the most brilliant and beautiful fishes are found in streams flowing over chalky and rocky soils. River-trout attain

to a length of 30 inches. Sea-trout or bull-trout are found 3 feet in length.

Tridac'na. The largest of the bivalve molluscs. A single shell has been known to weigh more than 500 pounds. The valves are deeply furrowed and handsomely grooved, and are used as ornaments for grottoes and fountains. The animal is edible, and one makes a meal for several persons.

Tri'lobite. A fossil crustacean belonging to the primary geologic age. There are numerous species in the Silurian and Devonian periods and a few in the coal strata,—named from their three-lobed bodies. Their nearest modern representative is the King-crab.

Trol'ley. Formerly a small truck or set of wheels carrying a box or car-body. Now a grooved wheel which rolls in contact with an electric wire, and takes off the current to transmit it to the motor of an electric or *trolley* car beneath.

Trump'et. A wind musical instrument with a clear and ringing tone. Its scale in the lower octaves is limited to the first natural harmonics, but by valves or pistons trumpets can produce every note in their compass.

Tset'se fly. An African insect, whose bite is harmless to man, but nearly always fatal to the ox, horse, or dog. It is about the size of the common house-fly, and lives by sucking blood. It is thought to transmit a disease germ to the blood.

Tube=rose. A variety of the primrose, cultivated in gardens for its vari-colored, gay-looking flowers.

Tu'lip. [Fr., from Per., a turban.] A garden plant growing from a bulb, and so called because of its supposed likeness to a turban. In the seventeenth century the cultivation of tulips in Holland became a mania, and tulip-bulbs were sold and resold as stocks on 'Change.

Tulle. [Fr.] A kind of thin silk or muslin netting for veils; so called from Tulle, a town in France.

Tum'bler. A large drinking-glass, formerly so made that it could not be set down without tumbling over, and thus requiring the liquid to be finished at one draught; a kind of pigeon which tumbles when flying.

Tun'ing=fork. An instrument of steel like a fork, which when struck gives out a fixed tone taken as a key-note.

Tun'nel. [Fr.] A passage underground or through a hill. The St. Gothard tunnel is 9½ miles long (48,840 feet); that of Mont Cenis, 39,840 feet; Hoosac, 25,080 feet; that under the Mersey 4½ miles, including approaches. Tunnels are now blasted out with nitro-glycerine fired by electricity.

Tun'ny. [Gk., to dart along.] A large fish of the Mackerel kind, found in the Mediterranean and Atlantic.

Tur'bine. [L.] A water-wheel with curved floats or buckets, against which the water acts either from above downward or from below, or inward from an external casing.

Tur'bot. [Fr., from L. *turbo*, a whipping top.] A large, round flat-fish of the Flounder kind.

used for food. The upper side is brownish and lower side white. It is voracious and feeds on other fishes. It is abundant in the North Sea. At one catch off Jutland 240,000 were caught, averaging more than one pound each. There are no turbot on the American coasts.

Tureen. [Fr., from *L. terra*, earth.] A large, deep dish of earthenware in which soup is served.

Turkey. A large scratching fowl, which received its name because it was by some supposed to come from Turkey, but really a native of North America. It is now bred in many countries. The tame turkey is duller in hue of feathers, but is generally much larger than the wild turkey. Its flesh is much valued, and in the United States roast turkey is the favorite Christmas dish.

Turmeric. The root of an East Indian ginger-like plant. It is used as a curry, to give color to varnishes, to dye silks and woollens yellow, and as a test for alkalies.

Tur nip. [Fr. *tour*, a turn; and AS. *naep*, a turnip.] A plant with a large round root, tapering downwards. A native of Europe and the temperate parts of Asia. It is a common garden vegetable, and in many countries it is largely grown for sheep and cattle food. The Swedish turnip, or *ruta бага*, is much used in Europe for this purpose.

Turpentine. [Gk. *terebinthos*.] The oily resin of the terebinth and some kinds of larch, fir, and pine. A cut is made through the bark of the tree, and the sap flows into jars. This is viscous like honey, and is crude turpentine. Oil of turpentine is distilled from crude turpentine, the solid part being yellow resin, used in making soap. Turpentine is used extensively in mixing paints and varnishes, and is also used in medicine.

Turquoise (*turkoi*s). [Same word as *Turkish*.] A precious stone of bluish-green or sky-blue color, brought from Persia. It is a phosphate of aluminum, its color being due to the presence of iron or copper.

Turtle. [From Span. for *tortoise*.] A reptile enclosed in a double shield or shell, from which the head, legs, and tail are protruded, but under which they can be drawn. The shell is an expansion of the vertebræ and ribs. Turtles do not shed their shells, and have no teeth, but have horny jaws. They are ocean swimmers, coming on shore only to lay their eggs in the sands.

Some of them are very large. The name is also often given to the land tortoise. (See *Tortoise*.) The green turtle is much esteemed as a table delicacy.

Tusk. [AS.] A very long, pointed tooth on each side of the mouth, found in certain wild animals, as wild boars, elephants, etc.

Twilight. [AS. *twi*, double; and *light*.] The dim, faint light before sunrise or after sunset. It is produced when the sun is 18° below the horizon by the reflection of the sun's light from the higher regions of the atmosphere. In the tropics the duration of twilight is shorter than in more northern latitudes.

Tympanum. [Gk.] The drum of the ear (*q. v.*)

Type. [Gk. *typtein*, to strike.] A letter cast in metal in a mold or cut in wood for printing. Including fancy types, some three or four hundred varieties of face are made. Besides ordinary Roman and Italic, the varieties most in use are Old English, Old Style, Clarendon, Antique, Black Letter, and Script. The principal sizes are—Ruby, Diamond, Pearl, Agate, Nonpareil, Minion, Brevier, Bourgeois, Longprimer, Small Pica, Pica, English, Greatprimer. Type-metal is an alloy of lead and antimony, sometimes with a little tin or nickel or copper. In type-founding a punch

or die is first made on the end of a bar of soft steel, and then hardened; then a matrix is made in copper, with a mold or box in two parts for casting.



TYPEWRITER.

Typewriter. A machine which is used to print Roman letters in place of script writing—for all work usually

done with a pen. There are many kinds, but most of them have key boards; by depressing these types are pressed against the paper through an inked ribbon.

Typhoon. A ferocious whirlwind or tornado, common in the China seas, and of irresistible violence.

U

Umber. [Fr., from *L. umbra*, shade.] A brown or reddish kind of earth, consisting of clays mixed with oxides of iron and manganese. It is used in oil and water-color painting.

Umbrella. [*L. umbra*, shade.] A shade or screen used as a protection from the rays of the sun or from rain. It is formed of strips of whalebone or steel fastened to a stick or hollow iron rod and covered with silk, cotton, or alpaca. Umbrella silk is made chiefly in Lyons and Crefeld.—The *umbrella tree* is an American magnolia with

white flowers and rose-colored fruit, the leaves being crowded on the top of the flowering branch in an umbrella-like circle.

Univalve. A mollusc whose shell consists of only one piece, as distinguished from the bivalve, or double-shelled molluscs, like the oyster. The univalves are the most numerous of the molluscs, and differ very greatly in size, shape, and color, many of them being very graceful and beautiful. A familiar example is the land snail,

U'pas. [Malay.] A poison, used to poison arrows, contained in the upas trees, a native of Java and Borneo. It was formerly supposed to have fatal effects, from its severe narcotic properties, to all animals which came under its shade. These stories are fabulous, but it exudes a gum resin which is very poisonous. It belongs to the bread-fruit genus.

U'ranium. [From the planet Uranus, discovered about the same time.] A metal discovered in 1789, as a constituent of several minerals. It is a very hard metal, resembling nickel and iron in appearance. Peroxide of uranium is used to color glass green or greenish-yellow, and a suboxide is employed in porcelain painting to produce an intense black. The metal is rare and costly.

U'ranus. The planet next beyond Saturn, and supposed to be the outermost until the discovery of Neptune. Its distance from the sun is 1,771,

000,000 miles; its diameter 31,700 miles; its year 84 earthly years in length.

U'ric Acid. A crystalline body present in the urine of man and of most mammals, and sometimes called lithic acid, because of its presence in calculus.

Ur'sa. [L.] The Bear—a name given to two



groups of stars near the north polar star. The Ursa Minor, or Lesser Bear, contains the pole star.

The Ursa Major, or Great Bear, consists of a group of seven bright stars, two of which—the pointers—point to the pole star.

V

Vaccina'tion. [L. *vacca*, a cow.] Jenner in 1796 noticed that persons who had much to do with cows, and who had caught from these animals a mild disease known as cow-pox, did not afterwards catch small-pox. The *lymph* by which the cow-pox is transmitted is a clear fluid obtained from a cow or a calf, or from the swelling on the arm of a vaccinated person. This lymph is introduced into the body by scratching the arm and then rubbing into the blood the lymph from little glass tubes.

Vac'uum. A space devoid of matter. The term is ordinarily applied to the results of the exhaustion of air from a chamber of glass or other substance. The vacuum produced by the air pump is far from perfect, and various means are in use to produce a more complete exhaustion. A very efficient one is the Sprengel pump, in which mercury flows down a long tube of narrow bore, and carries with it the air from a connected vessel. The best vacuum obtainable by the air pump is 150 times the millionth of an atmosphere; while the Sprengel pump yields .005 of the millionth of an atmosphere.

Val'ance. [Fr. *Valence*, a town near Lyons.] The hangings round a window or the lower part of a bed.

Valve. [L. *valva*, the leaf of a folding door.] A kind of flap or lid in a pipe or a blood-vessel which allows a fluid or gas to flow only in one direction, as in the common pump. There are a flap-valve, puppet-valve, ball-valve and slide-valve. A *safety-valve* is held shut by a spring or weight, and opens automatically to allow steam, gas, or water to escape when the pressure becomes too great. The valves in the blood-vessels assist the flow of blood through the veins.

Vanil'la. A climbing plant, native of Mexico and tropical America, with long pod-like capsules and a delicate odor. From it is extracted an oil used in confectionery and perfumery. The pods are cut and ground, and mixed with weak alcohol.

Var'nish. [Fr., from L. *vitrum*, glass.] A liquid laid on a surface to make it glossy. According to the solvents used, varnishes are divided into spirit, turpentine, and oil varnishes. The chief resins used in varnishes are copal, mastic, lac, benzoin, amber; and these are mixed in alcohol, turpentine, ether, linseed and olive oils.

Vas'eline. A yellowish, translucent, and odorless substance, obtained in the purifying of crude petroleum, used as an ointment and in the arts.

Vault. [Fr., from L. *volutus*, rolled.] A roof or ceiling in the form of an arch, or an underground room with arched roof. A groined vault has the roof groined, or with different cylindrical surfaces intersecting one another.

Veg'etable. [L.] A plant grown for food, as the cabbage, potato, turnip, etc. The *vegetable kingdom* is the primary division of living things, which includes all plants, and is divided into *Phanerogamia*, or plants having distinct flowers and seeds—sub-divided into exogens (*q.v.*), endogens (*q.v.*), and gymnosperms; and *Cryptogamia*, or plants without true flowers, and reproduced by minute spores,—subdivided into ferns, mosses, and liverworts, and the algæ, fungi, and lichens.

Vegeta'tion. The growth of plants. Vegetation occurs over the whole globe under the most opposite conditions. Plants flourish in the bed of the ocean as well as on land; under the extremes of cold and heat in the polar and equatorial regions; on the hardest rock and the soft alluvium of the plains; amid the snow of the mountains, in boiling springs, in dark caverns or mines. Different circumstances produce different species and genera. Absence of humidity, and extremes of temperature, are the conditions fatal to vegetable life. Trees and plants which occur in the plains dwindle with increased elevation. Plants are capable of extended naturalization, but distinct vegetable regions occur in different zones or on different heights.

Vel'lum. [L. *vitulus*, a calf.] Calf-skin prepared for writing, and finer kinds of parchments.

Veloc'ipede. A vehicle propelled by the feet of the rider. The common form is the two-wheeled bicycle, but tricycles and quadricycles are somewhat in use.

Vel'vet. [Ital. *velluto*.] A pile formed of silk, or a mixture of silk and cotton, by short pieces of thread crowded together, or woven with a third set of threads so closely that they stand up and hide the warp and woof. The rows of loops are slit with a sharp knife. *Cotton velvet* is an imitation velvet made of cotton, and sometimes called velveteen.

Veneer'. [Fr.] A thin slice of wood of one kind glued on the surface of another to give it a good appearance. (See *Wood*.)

Ve'nus. The second planet in order from the sun, from which it is 67,000,000 miles distant, and around which it revolves in nearly 225 days. Its diameter is about 7,760 miles, very near to that of the earth. The length of its day is not known.

Veran'da. [Port.] A kind of covered gallery or balcony in front of a house.

Verbe'na. [L.] A herbaceous plant with beautiful flowers. *Essence of verberna* is prepared from the lemon verberna, a plant with a lemon flavor.

Ver'digris. [L., green of brass.] Acetate of copper; poisonous green rust formed on brass or copper. It is used for making green paint and for dyeing wool black, in gilding and in calico printing.

Vermicel'li. [Ital., from L. *vermis*, worm.] Dough of wheat flour forced through small pipes or holes into worm-like threads. *Macaroni* is made through larger tubes.

Vermil'ion. [Fr., from L. *vermis*, worm.] A bright scarlet color got from the cochineal worm or insect. The vermilion of commerce is got by heating sulphur and mercury, and also by electricity. It is used in painting and in making sealing-wax.

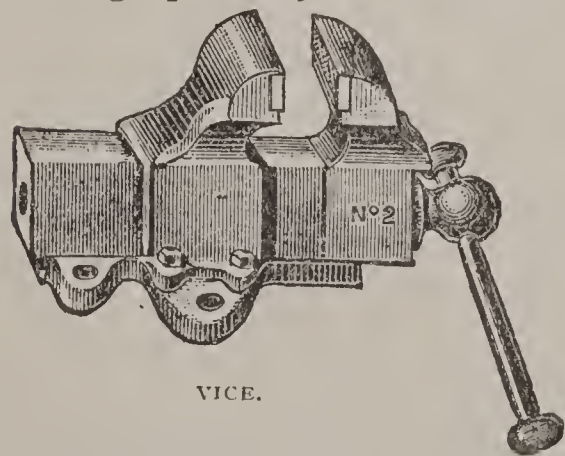
Ver'nier. A small scale made to slide along the edge of a larger one, 10 divisions of the smaller being equal to 9 or 11 of the larger. Invented

by Pierre Vernier to measure tenth and hundredth parts.

Ver'tebra. [L., a joint.] One of the twenty-six separate bones, called vertebræ, firmly united together to form the spinal column

or backbone (*q.v.*) in man and the higher animals.

Vice. [Fr. *vis*, a screw.] An instrument with two strong jaws, closed by a screw, lever, or cam, for holding things firmly when being filed. In the blacksmith's vice the front jaw reaches down further than in the machinist's and is loosely fastened at the bottom. Carpenters use wooden vices.



Vine. [Fr., from L. *vinum*.] A climbing plant bearing grapes from which wine is made. All the European varieties are supposed to belong to one species, *Vitis vinifera*. The chief districts are France, Spain, Portugal, Germany, Austria, and Italy, and this species is also grown in various other parts of the world, including California. There are several different species in the United States. (See *Grape*, *Wine*.)—Also any climbing or trailing plant, as hop vine, etc.

Vin'egar. [Fr.] A sour liquid, used as a relish for food, made from wine, cider, beer, malt, etc. The sourness is due to the presence of acetic acid, and of this there is from 3 to 5 per cent.

Vi'olet. [Fr., from L. *viola*.] A low creeping plant with a small flower, having a delicate fragrance. *Sweet violet* is the *Viola odorata*. *Pansy* is the *Viola tricolor*, and is also called heart's-ease.

Vi'olin. [Fr.] A musical instrument with four strings, played with a bow. Its tones are brilliant and of great power and variety, and in the orchestra it is the leading and most important instrument.—*Viola*, a violin a fifth lower in compass than the ordinary violin.—*Violoncello* [Ital.], a large bass violin with four strings, an octave lower than the viola.

Vi'per. [Fr., from L. *vivus*, living; and *pareo*, I beget.] A poisonous serpent; so named because it was the only serpent that was supposed to bring forth its young *alive*. The varieties include the common viper, the asp, the African horned viper, with a horny scale over each eye, Indian viper, and the red viper or copper-head, an animal like a rattlesnake without the rattles.

Vi'tascope. A moving series of photographs, giving the appearance of a living picture. Various names are given to the different forms of this, as biograph, mutascope, etc.

Vit'riol. [Fr., from L. *vitrum*, glass.] A glassy-looking substance consisting of sulphur and copper or zinc. Also the popular name for sulphuric acid (*q.v.*). *Blue vitriol* is sulphate of copper; *green vitriol* is copperas, or ferrous sulphate; *red vitriol* is a native sulphate of cobalt; *white vitriol* is zinc dissolved in sulphuric acid, and is a sulphate of zinc.

Volca'no. [Ital., from L. *Vulcanus*, god of fire.] A burning mountain, with an opening at the top called a crater, from which fire, steam, lava, cinders, etc., are thrown up.

Vul'canite. India-rubber (*q.v.*), or similar substance, hardened by heating with sulphur, and made into combs, buttons, etc.

Vult'ure. [L.] An important family of birds of prey. The neck of the vulture is bare, but at the lower part there is a loose fold of skin covered with feathers under which it draws its head to keep it warm. Vultures feed upon carrion, and seldom attack living animals. The condor, king vulture, turkey buzzard, griffin, and lammergeir are all vultures. The condor is the largest vulture of the New World and is found in the Andes. The lammergeir is found in Europe, Asia and Africa.

W

Wa'fer. [Fr. from Ger.] A thin cake of paste used in closing letters.—A thin cake or piece of ground bread used in the mass. This is usually unleavened, circular, and stamped with a crucifix or monogram.

Wag'tail. A small song-bird belonging to the genus *Motacilla*, and so called because it jerks its tail up and down. The common water wagtail is also called the pied wagtail. It is mixed white and black in color, and lives on the edges of ponds and streams. The *Wood wagtail* is found in Asia, and has a slender bill and short legs.

Wain'scot. A boarding or lining of oak or other timber in panels.

Wall-flower. A perennial plant with sweet-smelling flowers, growing in old walls and among ruins. It varies in color from yellow to orange and deep red.

Wal'nut. [AS.] A tree of large size, with alternate, pinnate leaves, found chiefly in North America. The black walnut is a beautiful timber tree found in the United States, with a heartwood of a warm brown color, a favorite wood for furniture making. The nut is round and oily, enclosed in a hard shell with a fibrous outer covering. The white walnut is a North American tree with long oily nuts, and hence called butter-nut. It also yields a valuable wood. There are some species found in Asia, whose wood is used in cabinet making, and the nut used for dessert and pickling. The nut yields walnut oil used in cooking.

Wal'rus. [Du., from Scand., the whale-horse.]



A large polar animal allied to the seal—also named *Morse*. Two of its upper teeth are prolonged into huge tusks, which measure from one to two feet, and weigh nearly five pounds. It is

one of the largest animals of the frozen regions. It sometimes measures eighteen feet in length, and weighs a ton. It is hunted for the blubber or fat that encases its flesh, which yields oil, and for its ivory tusks. Like the seal, it is a very clumsy animal on land or ice, and it is always found near open water. All it wants is a comfortable spot to lie on, the sea being its refuge in times of danger. The walrus is caught by means of a barbed spear or harpoon, which is suddenly thrust into its body by the native hunter, who has crawled slowly and silently within striking distance.

Warp. [AS.] The threads running the long way way of the loom and crossed by the woof. (See *Spinning, Weft*.)

Wart. [AS.] A small, hard growth on the skin, generally on the hands.—*Wart-hog* is a large African wild hog with large fleshy tubercles or warts behind the tusks, and a second pair behind the eyes, and with a mane along its back.

Wasp. [AS.] An insect somewhat like the bee, but its wings when at rest are laid over the body, and it has a deep division between the thorax and abdomen. Some live in colonies and some alone. When winter approaches all the wasps die except the females, which sleep through the cold. The nests of social wasps are built of paper, beautifully variegated and very durable. The young of social wasps feed on insects and larvæ brought to them by the old wasps, who feed mainly on honey and pollen of flowers and sweet juices of fruits. Some wasps make their nests in holes in the ground, and others fasten them to walls or the branches of trees. The sting of the wasp is barbed like that of the bee. Dry seasons are favorable to them. Sugar in some fruits, as grapes and plums, most attacked by wasps, turns into alcohol in the process of rotting, and this makes wasps somnolent, but inclined to sting. The mud-wasp deposits a supply of stunned spiders with its egg in a cell for the larva to feed upon. Sand and wood wasps are solitary kinds. The females dig out cells in rotten wood with their jaws. Sand-wasps dig holes using the hairs on their legs. (See *Hornet*.)

Watch. [AS.] A pocket timepiece. The train of wheels is the same as in a clock, but the main-spring and balance take the place of the weight and the pendulum in a clock. Watches are made mostly in Switzerland, England, France, and the United States. American watches are all made by machinery, the parts being cut so as to fit in all watches of the same kind. Watches are distinguished by the kind of escapement used—as verge, lever, duplex lever, and chronometer watch; also by the cases they are enclosed in—as open-faced, and hunters and half-hunters, which have closed and half-closed faces. Keyless watches, wound up by a knob on the stem, have taken the place of those wound up by a key.

Wa'ter. [AS.] The fluid which falls in rain and forms rivers and seas. Like air, water was formerly

considered a simple substance; but about a century ago the compound nature of water was discovered. Now it is a familiar fact that it is composed of two elements, oxygen and hydrogen, in the proportion of two parts of hydrogen to one of oxygen. At temperatures below freezing point (32° F.) water exists in the solid form of ice; between freezing point and boiling-point (212° F.) it takes the liquid form; and above boiling-point it exists in a gaseous state as vapor or steam. When the sun shines on the seas and rivers, the heat evaporates daily a quantity of

reason why water-pipes often burst in frosty weather. The blood, which carries the food to all parts of the body, and removes the waste matter from every organ, is more than three parts water; more exactly, in 100 lbs. of blood there are 79 lbs. of water. Water forms about two-thirds of the total weight of the body. In 100 lbs., lettuce contains 96 lbs.; cabbage, 92; apples, 83; fish, 78; potatoes, 75; lean meat, 72; bread, 40; cheese, 34; rice, 15; butter, 10, parts of water.

Watermelon. A fruit of a species of the genus *cucumis*, to which the cucumber also belongs, also the common musk-melon or cantaloupe. The watermelon plant is a running vine that bears a very large, round fruit, with dark-green spotted rind, and pink or white flesh, sweet in taste, and very juicy or watery. This makes it much prized in warm countries.

Wa'ter-gas. A kind of gas made by forcing steam over glowing coke. This yields a heat-giving mixture of hydrogen and carbon monoxide, which is charged with carbon and made suitable for illuminating purposes by passing through a volatile carbon.

Wa'terspout. A whirling storm at sea, similar in appearance to a tornado on land. From a dense cloud descends a conical pillar, of funnel-shape, under which the sea is violently disturbed, rising in a cone. Sometimes the two cones meet, but they more frequently disperse before meeting.

Waterwheel. A wheel turned by flowing or falling water and setting machinery in motion. There are three kinds, *overshot*, *undershot*, and *breast* wheels, named from the level



A DROP OF WATER, MAGNIFIED.

water. Rising up into the air, and carried along by the winds, this water-vapor is condensed, and falls as rain. Rain-water is in reality a kind of distilled water. It is not perfectly pure, for in falling it dissolves some of the carbonic acid gas out of the air, and also brings down impurities as soot. Water containing carbonic acid dissolves limestone and gains a condition called hardness, which may be removed by boiling or by adding lime-water. Pure water is clear, without taste, and colorless. Water is most commonly seen in the liquid state, but it is easily converted into a solid or into a gas. When liquid water is cooled, it contracts, or becomes less in size, until it reaches 30° ; if cooled still more, it begins slowly to expand; but when it is as cold as 32° , it suddenly expands, becoming about one-tenth larger, and forming the *solid* called ice. This is the

at which the water strikes their float boards. A *turbine* is a horizontal wheel with a vertical axis, driven by the weight and impulse of the water as it falls on the vanes around the axis.

Wave. [AS.] A moving ridge or swell on the surface of water. Waves in deep water move onward, but the water of which they are composed is continually changing. Scoresby gave 600 feet as the maximum length of sea waves. In 1888 the *Umbria* was struck by a wave 50 feet high.—Heat, sound, and light are supposed to travel in waves. The *wave theory of light* regards its phenomena as due to transverse waves in an ethereal medium, their amplitude causing brightness of light, and their frequency causing its color. The colors of the spectrum are estimated to result from various rapidities of vibration, ranging from 459 to 727 millions of millions per second.

Wax. [AS.] A thick sticky stuff of a yellowish color made by bees (*q. v.*) to form cells for honey, and used in making sealing-wax (*q. v.*), in modeling and in making wax-cloth or floor-cloth. *Mineral wax* is a substance resembling wax, found in connection with deposits of rock-salt and coal, and is also called ozocerite. *Chinese wax* is secreted by the wax-insect used in candles and medicine. *Wax-palm* is a tree found in the Andes. Its stem is covered with a secretion consisting of resin and wax, which when melted with fat makes excellent candles. *Wax-bill* is an Asiatic and African finch-like bird with a beak red like sealing-wax.

Weasel. [AS.] A small flesh-eating animal with red and white soft silky fur. Its body is about seven inches long, its legs are short, and it has five claws on each foot. Its head is round, its muzzle sharp, its ears small and pointed, its jaws powerful, and it has whiskers like those of a cat. Its sense of smell is keen, its sight good, its hearing quick, and it glides like a snake, or runs swiftly, and jumps or climbs walls and trees with great ease. It is seldom seen during the day, but prowls at night in search of food. It feeds on rabbits, moles, mice, frogs, and birds. It is fond of blood, and likes to suck eggs in the poultry-yard, making a small hole in the end of the shell. Farmers favor weasels because they kill many vermin. In attacking their prey, they generally seize the animal by the back of the neck and drive their teeth into the brain. The weasel makes a nest of dry grass and leaves in a tree or ditch.

Weather. The state of the air at any time as regards heat, moisture, wind, rain, clouds, and electricity. The pressure of the atmosphere is an important factor in bringing about atmospheric changes, because air always flows from a region of high pressure to one of low pressure. The pressure of the atmosphere at any place is obtained from the readings of the barometer; but the direction and force of the wind depend upon the relative distribution of pressure at a given time over a large extent of country, and not upon the actual reading of the barometer at the particular place. Simultaneous observations are made at as many different stations as possible within the given area, and are communicated to a central station, where the readings are compared and the distribution mapped out. The direction of the wind can then be inferred from the fact that it blows from where the pressure is high to where it is low. The place where for the time being the pressure is lowest is said to be the seat of a barometric depression, and the heaviest fall of rain generally takes place in the neighborhood of such a depression. In the Weather Bureau of the United States, 83 per cent. of the forecasts given twenty-four hours previously have proved correct.

Weaver-bird. A bird like a finch or sparrow, found in Asia and Africa, with hanging nest composed of interlaced grass. Some make their nests in the shape of a retort, with the opening at the bottom of the tube.

Wedge. [AS.] A piece of wood or metal, thick at one end and thin at the other, for splitting or fastening. The wedge is one of the six mechanical powers.

Weed. [AS.] Wild plants in cultivated ground. Weeds injure crops in several ways. They absorb some of the plant-food which has been prepared for the crop, and they keep air and sunlight from the cultivated plants, which look sick and weakly in consequence. The hoe is an instrument much used for destroying weeds. On a good farm, land is fairly *clean*, or free from weeds.—*Sea-weed*, any marine plant of the class Algæ, or any plant growing in the sea.

Weft. [AS.] The cross threads of a web carried by the shuttle from selvage to selvage, *woven* into the warp.

Well. [AS.] A deposit of water reached by a hole sunk in the earth. The water in *wells* is of the same nature as that of springs. Many towns are supplied with water from deep wells which reach beds of sandstone, lying perhaps 500 or 1,000 feet below the surface. The water of shallow wells in towns is almost certain to contain sewage, which has passed from cess-pools or leaky drains through the soil and gravel or sand until it has reached the well. (See *Artesian Well*.)

Whale. [AS.] A large swimming animal. The whale is not a fish, for its young are born alive, and are suckled, instead of coming out of eggs as young fishes do. Seals have feet that are more fitted for moving through the water than for moving on land; but whales cannot move on land at all, for they have no feet. Some kinds of whales are the largest animals in the world. Whales are sometimes found in large herds, or "schools" as they are called. They are killed for their oil by the harpoon (*q. v.*). When a harpoon has struck a whale, the rope fastened to its handle is quickly let out over the side of the boat, and the whale pulls it so swiftly that the men are obliged to pour water over it to prevent setting the wood on fire. When once a harpoon has pierced a whale, it can only be got out by cutting the flesh. A dying whale often struggles so fiercely that it is dangerous for a boat to be near it. The bomb-lance and gun now used in killing whales are safer and more expeditious. The sperm whale (*q. v.*) has very sharp teeth in its lower jaw, with which it can crush a boat. One monster actually destroyed nine boats. Its jaw is 16 feet long, 7 or 8 broad, and about 10 in height. The thrasher, a large and voracious shark with a long upper lobe on its tail, often beats or fights the whale. The Greenland whale, the rorqual, and one or two other kinds, have whalebone instead of teeth. The whalebone, of which there are 360 plates or pieces in one animal, is fastened to the upper jaw of the mouth, and hangs down. Each piece is from 10 to 14 feet in length, and is 11 inches broad at the root; and one whale yields one or two tons of whalebone. The blubber or inner skin, which contains the oil, may be 16 inches thick, and a large whale may yield 275 barrels of oil. The throat

of the Greenland whale is so narrow that it can swallow only the very smallest animals, such as shrimps and small jelly-fish, which are caught as in a net by the brush-like fringes on the edges of the whalebone. The throats of the spermaceti and rorqual whales are much larger. The rorqual is the largest member of the Whale family. Some of them are 85 feet long. But they are so savage, and their oil and blubber so inferior, that whalers do not often attack them. The whale has no hair, but the blubber keeps the outer skin oiled, enables it to resist the water, keeps out the cold, and from its lightness causes the body of the animal to float easily. The whale moves by its tail, which is so strong that it enables the largest of these animals to leap right out of the water. It uses its fins, or fore limbs, to balance itself, and also to grasp its young, of which it is very fond. The whale cannot remain long under water, and must come up for air every little while. But the nostrils of the animal are placed on the top of its head, so that when it rises very little of its body is seen. These nostrils are called blow-holes, and through them it spouts up spray as well as its own warm breath to a great height. The sperm whale has only one blow hole. When under water the animal can protect both nostrils and ears by a sort of round stopper of skin and muscle, which fits so closely that not a drop can get in. Whales, often in hundreds, feed on the outskirts of herring and other fish shoals. The dolphin and porpoise are smaller members of the Whale family.

Wheat. [AS.] One of the cereal plants from whose seeds bread is made. After Indian-corn, it is the most important of American food plants, and is widely grown in the temperate regions of the remainder of the world. Rice replaces it in importance in the tropics and in China. Wheat is, on the whole, the hardiest of the cereals, though oats are grown in regions where there is not enough heat to ripen the wheat. It is also the most costly of the cereals, yielding less and exhausting the soil more. There are many varieties—*autumn* and *spring*, from the times of sowing; *red* and *white*, from the colors of the grains; *bearded*, having ears with awns; *beardless*, having none; and *rivetts*, with a coarse straw. An average crop is from 25 to 30 bushels of wheat and 3,000 lbs. of straw from each acre. Silica and potash are especially needed by wheat, and so it grows well on stiff clays which contain much silica. Wheat has never been found growing wild in any part of the world. It was cultivated in Britain in the time of the Romans. It is now chiefly produced in North America, France, Russia, Germany, Italy, Hungary, and India. The United States is the greatest wheat producer, yielding in some years more than 600,000,000 bushels, while the yield of the whole world in 1899 was 2,725,000,000 bushels.

Wheel. [AS.] A circular frame turning round on an axle. The radii are spokes which are fixed in the nave or hub, through which is inserted the axle.—*Wheel and axle*, one of the six simple machines or mechanical powers, consist-

ing of a wheel fixed to an axle, used for raising weights by a rope. The principle of equilibrium is the same as in the lever, but continuous. The gain in power is in proportion to the size of the circumference of the wheel as compared with that of the axle. If the circumference of the wheel be ten times that of the axle, then one pound attached to the wheel will balance ten pounds applied to the axle.

Whelk. [AS.] A shell-fish with a spiral shell, belonging to the genus *Buccinum*. It is common on the coasts of Europe and North America, and is used for food.

Whey. [AS.] The watery part of milk separated from the curd in making cheese. The greater part of the whey is water; but in this water are dissolved the *milk-sugar* and the *mineral matter* of the milk; the mineral matter is chiefly *phosphate of lime*. In 100 lbs. of cow's milk there are 92 lbs. of whey, consisting of—water, 86 lbs.; milk-sugar, 5 lbs.; mineral matter, 1 lb.

Whippoorwill. A North American bird of the Goatsucker or Nightjar family. It takes its name from its loud and plaintive nocturnal cry. Some regard it as a bird of ill omen.

Whirlpool. A body of water whirling in a circle, and drawing into its centre whatever enters its waters. Whirlpools are situated in channels similar in configuration and in tidal phenomena. Charybdis is in the Straits of Messina. Maelstrom is on the north-west coast of Norway. Corrie-vrekin is in Jura Sound, Scotland. The Niagara whirlpool is really a large eddy in which whirlpools are constantly forming.

Whiskey. [Celt. *uisge*, water.] Spirit distilled from grain, potatoes, etc. Scotch or malt whiskey has the malt dried over a peat fire; Irish or grain whiskey is made from raw barley.

Whist. [From *hush*.] A game of cards for four, in which each person holds thirteen cards, and when these are played out the cards are shuffled and again given out. In short whist five points make the game, and two games a rubber.

Whitebait. A small fish of the Herring kind, prized for food. It is supposed to be the fry of both herrings and sprats, the proportion of the latter being greater in winter, while the herrings are more numerous in the summer. Thames whitebait possibly find more suitable food there, and may be superior in condition and flavor.

Whortleberry. [Cor. of *myrtillus*.] A plant which grows abundantly in heaths and woods, and bears evergreen leaves, and a blue berry which may be eaten; also the bilberry, and in America the huckleberry. The cowberry has red fruit. The cranberry is closely allied to the whortleberry.

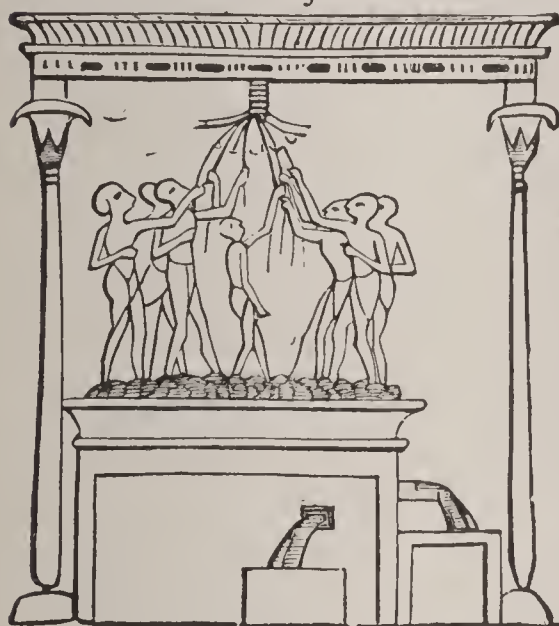
Willow. [AS.] A tree whose branches are slender and easily bent, used for basket making and wicker-work. The *Weeping* willow is a very ornamental species of Chinese origin, and has long slender branches that hang down almost perpendicularly. The *Pollard* willow is one with its trunk cut back to throw out fresh and numerous osiers. The *White* willow, the largest species known in Britain, and the *crack* willow, are used

in making charcoal. Willows occur in temperate and moist climates, but they have not been found in Australia or the South Sea islands.

Win'cey. A cloth made of linen and wool mixed. Also called linsey-woolsey.

Winds. Currents of air having their origin in the different pressures which exist in various regions of the atmosphere. Since the sun is shining more powerfully upon the equatorial than upon the more northern regions of the globe, the heated and therefore rarefied air ascends, while a current of colder air flows in from the poles on both sides to take the place of the ascending air. The ascending column of air flows over from the equator towards both poles, so that the general atmospheric circulation consists of an under current from the north and south poles towards the equator, and of an upper current from the equator towards both poles. This general circulation proceeds in spite of other circulations on a smaller scale or of a local character which may be going on at the same time. North-east and south-east trades occur in the northern and in the southern hemisphere. (See *Weather* and *Trade Winds*.)

Wine. [AS., from L. *vinum*.] A drink made from the sweet juices of fruits, which are pressed out, allowed to ferment, and then bottled. Grapes are chiefly used for wine-making. *Sherry* and *port* are made in Spain and Portugal. *Claret* is a light, rather acid kind of wine, made in France; from which country we also get *champagne*, a wine which contains much carbonic acid gas. The wines of Southern



ANCIENT EGYPTIAN WINE PRESS.

Europe excel in body and strength, but lack the aroma of Rhine wines. Large quantities of wine are now produced in the United States, especially in California. On an average, 100 lbs. of wine contains from 10 lbs. to 15 lbs. of alcohol. When wine is heated in a closed vessel, the alcohol rises out of it as vapor. If the vapor be then made to pass through a tube surrounded by cold water, it will be condensed to brandy.

Wing. [Scand.] The appendage of the body of a bird or insect, by means of which it flies. The framework of the bird's wing is formed of a set of bones corresponding to those of the human arm and hand, but having only one perfect finger, corresponding to the index finger; and stretched over this framework is a thin covering of flesh and muscle from which grow the quills and smaller feathers, and these when spread out make up the broad wing. The upper surface is rounded, and the air can easily slide from its

edges as it mounts in the air. Bats are the only mammals which fly, and their wings are arms and fingers lengthened out, and supporting a skin spread out like the cover of an umbrella on its ribs. There are other mammals, like the flying squirrel, the flying lemur, etc., which have a partial power of flight. The wings of insects are thin, often transparent, membranes. Some insects use them for only a brief period of their lives; the ants, after their marriage flight, cast off their wings and live without them afterwards. Some, as the flies, have two wings, but most insects have four.

Witch. A woman supposed to have a compact with the devil or with evil spirits, and given the power to perform supernatural acts. A man with similar power is called a *wizard*. Supposed witches have been persecuted from the times of Moses downward until about a century ago, and great numbers of persons have been put to death on accusation of witchcraft.

Win'tergreen. A common American plant, about 4 or 5 inches high, with small whitish flowers and red berries. It is also known as partridge-berry, checker-berry, mountain tea, and by other names. The plant has a pleasant aromatic taste and odor, and yields the *oil of wintergreen*, used as a stimulant, for flavoring syrups, and in perfumery.

Wireless Telegraphy. A newly invented method of sending electric telegraph messages without the aid of wires. The best-known invention is that of Marconi, an Italian electrician, the message being sent by the use of a powerful current of high frequency, which passes through the ether or the earth and acts on a suitable receiving instrument many miles distant. The distance to which messages can be sent is annually increasing.

Wolf. [AS.] A carnivorous animal of the Dog family. It is very cruel, fierce, and destructive, but is capable of great affection. In many respects it is like a neglected savage dog. It does not bark, but gives a hoarse howl; nor does it lap like the dog, but drinks by sucking. There are many kinds, varied in size, thickness of fur, and in color. The ordinary color is a yellowish gray, but there are also black, brown, and white wolves. They are found in Europe, Asia, and North America, but not in South America or Africa. Wolves do not lie in ambush, but run down their prey in open chase, their favorite prey being the allied species of the domestic dog and the Arctic fox. The coyote or American prairie wolf and the Japanese wolf are smaller species than the ordinary wolf or *Canis lupus*.

Wood. [AS.] The solid part of trees; trees cut down and sawn into boards. The wood used in the construction of houses is chiefly obtained from pine and from fir trees, the wood of both being called pine-wood. When sawn into boards it is known as deal; when split into thin narrow strips, it forms laths. The wood should be seasoned or thoroughly dried by exposure to the air for one or two years after the tree has been cut down. For making furniture, hard woods, such

as oak, maple, cedar, ebony, walnut, mahogany, and rosewood, are used. The two latter are often cut into very thin slices, called *veneers*, which are then glued on the surface of beech or some other cheap wood and made into furniture. Besides its importance in building and the manufacture of furniture, wood is necessary as fuel, and is greatly used in countries covered with forests where coal is not easily obtained. The toughest wood is pig-nut hickory; next, white oak and white ash. (See *Lumbering*.)

Wood'bine. [AS.] A climbing plant with sweet-smelling flowers; the honeysuckle.

Wood'chuck or **Ground=hog.** An American species of the Marmots, a genus of rodents. This animal, from 15 to 18 inches long, burrows in the earth, and often commits great havoc in fields of clover, of which it is very fond. The *prairie-dog* is allied to the marmots.

Wood'cock. A bird allied to the snipe, frequenting woods, and considered as game. It is nocturnal in its habits. The little woodcock is the snipe.

Wood'pecker. A bird having a hard pointed bill for pecking holes in trees, and a long tongue for drawing out insects from holes or crevices. This tongue is armed near the end with sharp barbs, pointed backward like a fish-hook. The tongue is fastened to cartilages which extend up to behind the skull and over the forehead, and in consequence of this it can be thrust out some distance beyond the beak. Apple and maple trees are sometimes pierced by the woodpecker's holes in rings one above the other, just as farmers pierce the maple. The nest is lodged in a pear-shaped hole made in a tree-trunk, much larger than the circular entrance at the top.

Wood=pulp. A fibrous material prepared from wood by grinding or by chemical means, and used, soaked in water, for making printing and other paper, and for various small wares, such as plates, basins, and pails. It has been used as a filling for car-wheels, in making bricks and tiles, etc., and even for making an imitation silk thread.

Wool. [AS.] The natural covering of certain animals, the best known of which is the sheep. The sheep is a tame or domestic animal, but in certain countries, as Asia, North America, and in parts of Europe (Sardinia and Corsica), wild sheep still abound. The entire coat of wool growing on any one sheep is called its fleece. This fleece is usually cut off or shorn once a year. The countries producing most wool are England, Australia, Cape Colony, Saxony, Spain, United States, and Mexico. Wool is remarkable for its softness, and the wavy nature of the separate fibres. When the fibres are drawn through the fingers in one direction, they feel smooth; but in the opposite direction they are rough, and seem to catch. The wool, being cut and carefully prepared, is spun into yarn by a machine which twists the fibres together, so as to form them into a long thread; the waviness of the fibres and the projecting scales help them to hold firmly together. The yarn is then woven

into cloth. Any piece of woollen stuff consists of two sets of threads—one set called the warp, running the long way of the piece; and another set called the weft, running across, and interlacing with the warp. Lastly, the woollen cloth, as we may now call it, is dyed and pressed; the nap is raised by a process called teaseling, and the material is then ready to be made into clothes. When wool is spread out in a thin layer, well moistened, and then beaten smartly with a rod, the fibres become matted together, and form a material called *felt*, of which hats, carpets, etc., are made. Wool is a bad conductor of heat, and so prevents its escape from the body. At the same time wool is a good absorber of moisture, soaking up the perspiration as soon as it comes out of the skin. Owing to the roughness of the fibres, woollen materials gently chafe or rub the skin, and so promote its healthy action.

Worm. [AS. *wyrm*, a worm or snake.] Earth-worms are humble animals, yet they are valuable aids to the agriculturist. On making a section down through the earth for several feet, there will be found innumerable tunnels formed by worms. A naturalist considers that they average 100,000 to the acre, and in especially rich ground in New Zealand it was estimated that there were 348,840 in a single acre. This vast body of worms is continually at work boring this way and that, coming to the surface during the night and retreating to greater depths during the day; and their tunnels constitute a system of irrigation and ventilation. Rain, instead of running off, enters the holes, and so penetrates the earth, thus being held for a longer time. Air also finds its way below the surface. But this is a very small part of the work accomplished. Worms are continually swallowing the earth and depositing it at the surface, and working it over and over. Darwin states that the vegetable mold thus transported in some places amounts to ten tons an acre. Worms not only carry all this material to the surface, but they drag vast quantities of leaves and other matter down that serve to enrich the soil and render it capable of producing larger crops. Some worms are a foot in length. Their bodies are formed of a large number of rings. On each ring there are a great many bristles. Grubs move forward by means of their tiny feet, snakes by means of their scales, and worms by means of their bristles. Their bodies are very elastic. The worm pushes forward its head, the bristles in the front part of its body take hold of the ground, and the rest of the body is then pulled along. In addition to the earth-worms, the name worm is applied to a large variety of elongated water animals, very many of them dwelling in the ocean, also to numerous internal parasites, some of which dwell in the human body. (See *Tape*.)

Worst'ed. [From Worsted or Worstead, a village in Norfolk.] Wool twisted into thread used for knitting stockings. Long yarn is made by drawing, gilling, and combing. Short wools are first carded and afterwards combed. Worsted for carpet-yarns or knitting-yarns is carded only.

Wort. [AS.] A plant of the Cabbage kind; also the sweet liquor obtained by steeping crushed grain in hot water, which ferments and forms beer (*q. v.*).

Wren. [AS.] A small brown bird having active and lively habits. It has a domed nest needlessly large for the size of the bird, and near an occupied nest are generally one or more nests unfinished.

ished. It is extensively found in Europe, and inhabits Palestine. The winter wren and house wren are common in North America. In Britain there are the wood wren and willow wren; also the chiff-chaff, which, from its nest, is sometimes called "oven" bird. Wrens, like robin red-breasts, whistle all the year round, times of hard frost excepted.

Y

Yacht. [Du.] A swift, light boat fitted up for pleasure-sailing or for racing. Yacht-racing dates from the beginning of the nineteenth century, during which it was greatly developed. Important international yacht races took place between England and the United States, in nearly all of which the latter was victorious.

Yak. [Tibetan.] A large ox, very sure-footed, found in the plains of Central Asia. It is like the long-horned Scottish cattle, but more strongly built. In color it is black, and it has long hair, especially at the hind quarters, where it touches the ground. The wild yak is found always just under the snow-line; the tame yak is seldom employed below 12,000 feet above sea-level. The tails of domestic yaks are employed in India as fly-flaps.

Yam. A large plant, with roots somewhat like the potato, grown in warm countries. The clusters of flowers are separately small, but together are showy. Most yams contain an acrid matter which is lost in cooking. The true yam is sometimes confused with the sweet potato, which is convolvulus.

Yarn. [AS.] The fibre of cotton, flax, hemp, silk, or wool spun into threads. Throughout all the changes of modern yarn-spinning, the rotating spindle continues to be the chief implement.

Yawl. [Du.] A small ship's boat rowed with four or six oars.

Year. [AS.] The time which the earth takes to go round the sun. The *tropical year* is the interval between two successive passages of the sun through the first point of Aries. Its mean length is 365 days 5 hrs. 48 min. 49.7 sec. Owing to the precession of the equinoxes it is shorter than the *sidereal year*, which is the interval which elapses between the time of the earth's leaving a given point in its orbit and the time of its returning to it. It consists of 365 days 6 hrs. 9 min. 9.6 sec. The order of the seasons is determined by the tropical year. The year is accounted 365 days in length, except every fourth year, which is named *leap year* and has 366 days. As this would make the average year rather too long, the last year of the century is not leap year unless its unit number can be divided by four. Thus 1900 was not leap year, but 2000 will be.

Yeast. [AS.] The froth that rises on the top of liquors in the process of fermentation; or the substance used for raising dough to be baked into bread (*q. v.*). Although yeast looks like a liquid to the naked eye, yet under the microscope a

drop of yeast is found to contain thousands of extremely small rounded bodies, which are tiny



YEAST FUNGUS, MAGNIFIED 400 TIMES. "spores" or

"seeds" of the yeast-plant (which are always floating about in the air) have settled in it and begun to grow, which they do with wonderful rapidity.

Yellow Bird. This bird is known as the American Gold-finch or Thistle-bird. It is generally distributed over North America. The male is bright yellow, with black tail and wings marked with white and with black on top of the head; the female is yellowish brown above and darker brown below. They are usually seen in flocks, feeding on the seeds of thistles, sunflowers and other plants.

Yel'low-hammer. A British song-bird with yellow feathers. This bird breeds late, and continues to sing until late in the year.

Yew. [AS.] An evergreen tree like the pine, used either in hedges or separately. Its wood is hard and close-grained, and its young branches, owing to their toughness, were formerly much used for bows. Old yews are common near churches. The leaves have poisonous properties.

Yolk or Yelk. [AS.] The yellow part of an egg. It has a thin skin around it, and has in it a little jelly-like germ, from which the young bird develops. (See *Egg*.)

Yuc'ca. [Span.] A kind of lily peculiar to North America. Some kinds have underground stems and dagger-like leaves; others have palm-like stems crowned with dense tufts of leaves. They yield coarse fibres used for ropes and cloth, and are grown as ornamental plants. The plant is popularly called "Adam's Needle."

Yule. [AS.] The old English word for Christmas, still used in provincial parts of England. The bringing in of the *Yule log*, for burning on the Christmas hearths, was a festive ceremony.

Z

Ze'bra. [Port.] A kind of wild ass, of the genus *Equus*, perhaps the most beautiful animal of this tribe. It is pale yellow or white in color,



with black or brown stripes. It lives in large herds in the mountainous parts of Africa, and is very wild. Few zebras have ever been tamed.

Ze'bu. [Fr.] A variety of the Ox family with short horns, long ears, and a large hump over the shoulders, found in India and the Asiatic islands, and along the east coast of Africa. Some are of large size and others as small as a sheep.

Ze'nith. [Fr., from Arab.] The point in the celestial sphere which a person standing on the earth at any point sees directly overhead; directly opposite to the *nadir*.

Zinc. A metal of a bluish-white color, having a crystalline structure. It is brittle at ordinary

temperatures, but when heated it becomes malleable, and does not lose this quality when cooled. If raised to a red heat in a closed vessel, it will boil and pass off in vapor, and when heated in the air it burns with a bright flame. When exposed to damp air, a thin coating of rust is formed, which prevents the further oxidation of the metal. Combined with copper, it forms the alloy brass, and it also forms an ingredient in German silver. In the metallic state it is used for roofing, for rain-pipes, for gutters, and as a coating for sheet-iron and iron wire. Iron covered with zinc in this way is known as *galvanized* iron. Zinc is also used in some electric batteries; and as an oxide it is employed as a pigment.

Zo'diac. A broad belt running round the heavens parallel to the ecliptic, and extending about 8° on each side of it. It is the area within which the motions of the sun, moon, and the greater planets lie. The stars in the zodiac have been divided into twelve groups called constellations—Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricorn, Aquarius, Pisces. These divisions do not now coincide with the constellations as formerly; for by the precession of the equinoxes they have been moved back about 25° behind the constellations.

Zodiacal Light. A remarkable luminous appearance in the sky, seen in the west after sunset, and in the east before sunrise, at certain seasons of the year. It is a triangle of light, of greatest intensity within the tropics, where its brilliancy sometimes rivals that of the Milky Way. It stretches through the sky nearly in the direction of the sun's equator. It is only during the spring and autumn that in our latitudes it can attain sufficient height in the sky to be distinguishable.

ABBREVIATIONS.

The following are the most common abbreviations used in this book :

Arab. or Ar.	Arabic.
AS.	Anglo Saxon.
Braz.	Brazilian.
Celt.	Celtic.
Chin.	Chinese.
Cor.	Corresponding.
Dan.	Danish.
Du.	Dutch.
Fr.	French.
G.	German.
Gk.	Greek.
Goth.	Gothic.
H.	Hayti.
Heb.	Hebrew.
Hind.	Hindu.
Icel.	Icelandic.
Ital.	Italian.

L.	Latin.
L. Lat.	Low Latin.
Malay	Malayan.
O. E.	Old English.
O. F.	Old French.
Pers.	Persian.
Pl.	Plural.
Port.	Portuguese.
q. v.	which see.
Sax.	Saxon.
Scand.	Scandinavian.
Sing.	Singular.
Sp. or Span.	Spanish.
Swed.	Swedish.
Turk.	Turkish.
W. Ind.	West Indies.



THE GREAT MONARCHS OF EUROPE

BOOK X.

BIOGRAPHY

THE WORLD'S GREAT MEN AND WOMEN AND WHAT SHOULD BE REMEMBERED OF EACH—ALPHABETICALLY ARRANGED—A BOOK OF UNTOLD VALUE FOR LEARNING THE RIGHT THING ABOUT THE RIGHT PERSON—A THOUSAND WORTHIES OF ALL TIMES AND ALL COUNTRIES.

GREAT MEN AND GREAT WOMEN OF ALL TIMES

FAMOUS MEN AND WOMEN

A DICTIONARY OF DISTINGUISHED PEOPLE OF THE WORLD—
EMBRACING THEIR NATIONALITY, VOCATION, GREATEST
ACHIEVEMENTS, AND DATES OF BIRTH AND DEATH.

- Abbott, J. S. C.** American historian. *Life of Napoleon Bonaparte; History of Russia.* Born, 1805; died, 1877.
- Abbott, Emma.** A noted American singer and prima donna. Mrs. E. J. Wetherell. Born, 1849; died, 1891.
- Abbott, Lyman.** American clergyman and author; succeeded Beecher as pastor of Plymouth Church; editor *Outlook*. Born, 1835.
- Adams, John.** American President and diplomatist, graduated at Harvard; school-teacher and lawyer; defended British soldiers implicated in Boston Massacre, 1770; delegate to Continental Congress, 1774; commissioner to France, 1778; minister to Holland, 1781; one of the negotiators of treaty of peace with Great Britain, 1782; minister to Great Britain, 1785-88; Vice-President, 1789-97; President, 1797-1801. Born, 1735; died, 1826.
- Adams, John Quincy** (son of John). American President and diplomatist, graduated at Harvard; minister to Holland, 1794; to Prussia, 1797; elected to U. S. Senate by Federalists, 1803; resigned, 1808; minister to Russia, 1809; one of the negotiators of the treaty of peace with Great Britain, 1814; minister to England, 1816-17; Secretary of State, 1817-1825; President, 1825-29; M. C., 1830 till his death. Born, 1767; died, 1848.
- Adams, Samuel.** American Revolutionary patriot and statesman; Governor of Massachusetts; one of the foremost popular leaders of the Revolution. Born, 1722; died, 1803.
- Addison, Joseph.** English man of letters, poet, humorist, moralist, dramatist; Under-Secretary of State, 1705; M. P., 1708. His poem *The Campaign*, on the battle of Blenheim, had a great success. Much of the *Tatler* (edited by Steele) and three-fourths of the *Spectator* are his. Born, 1672; died, 1719.
- Æschines.** Athenian orator; rival of Demosthenes, and supporter of Philip of Macedonia. *Orations.* Born, B. C. 389; died, 314.
- Æschylus.** Sublime Athenian tragic writer. *Agamemnon the Persian.* Born, B. C. 525; died, 456.
- Æsop.** Greek fabulist of the 6th century B. C. *Fables.*
- Agassiz, Louis.** Swiss naturalist and man of science, Professor at Harvard; founder of the Museum of Comparative Zoology at Cambridge, Mass. *Researches on Fossil Fishes.* Born, 1807; died, 1873.
- Agricola, Cnæus Julius.** Roman general; built line of fortresses across Scotland; father-in-law of the historian Tacitus. Born, 37; died, 93.
- Agrippina.** Mother of the Emperor Nero, infamously cruel and sensual; put to death by Nero. Born, 15; died, 60.
- Aguinaldo, Emile.** A Philippine soldier and statesman; leader of the revolt against Spain and the war against the United States; captured and took oath of allegiance to the United States in 1901. Born, 1869.
- Alaric I.** King of the Visigoths, captured Rome. Born, 350; died, 410.
- Albert, Prince Consort of England;** husband of Queen Victoria; man of noble character. Born, 1819; died, 1861.
- Alcibiades.** Athenian statesman and commander. Led Athenian fleet; conquered at Cyzicus and Cynossema; annexed Chalcedon and Byzantium. Handsome, talented, fickle, vain. Born, 450; died, 404.
- Alcott, Louisa M.** American author. *Little Women; An Old Fashioned Girl; Hospital Sketches.* Born, 1833; died, 1888.
- Aldrich, Thomas Bailey.** American novelist and poet. *Prudence Palfrey; The Story of a Bad Boy.* Born, 1836.
- Alexander the Great,** King of Macedonia, conqueror. Aristotle was his tutor. He came to the throne in 336, razed Thebes, and was chosen by the Greeks commander of the forces against Persia; invaded Asia Minor (334), beat Darius at the Granicus, and cut the Gordian knot; defeated Darius at Issus (333); captured Tyre (332), invaded Egypt and founded Alexandria; routed Darius at Arbela (331); took Babylon, Persepolis, Susa, and invaded India till his army refused to proceed farther; died at Babylon. Born, B. C. 356; died, 323.
- Alexander VI.** (Borgia.) Pope 1492-1503. Infamous for his crimes. Born, 1430; died, 1503.

- Alexander I.** Czar of Russia (1801-25); one of the chief opponents of Napoleon, reorganized Russian army. Born, 1777; died, 1825.
- Alexander II.** Czar of Russia (1855-81); liberator of the serfs. Assassinated. Born, 1818; died, 1881.
- Alexander III.** Czar of Russia (1881-94.) Born, 1845; died, 1894.
- Alfieri.** An Italian dramatist. Spent his youth in dissipation; reformed and devoted himself to dramatic art. "Cleopatra" was his first successful drama. Tragedy was his *forte*. Buried at Florence. Born, 1749; died, 1803.
- Alfred the Great.** King of Wessex. Came to throne 871; lived in concealment to escape Danes; routed Danes, 878; allowed them to settle in his kingdom; repelled invasion of the Northmen, 896; founded a navy; established schools and a police system; encouraged literature. Born, 849; died, 901.
- Allen, Ethan.** American Revolutionary soldier; captured Ticonderoga "in the name of the great Jehovah and the Continental Congress." Born, 1737; died, 1789.
- Alva, Duke of.** Noted Spanish general during reign of Charles V. and Philip; Governor of the Low Countries; noted for his merciless cruelty. Born, 1508; died, 1582.
- Ames, Fisher.** American orator and statesman; Federalist member of Congress. *Speeches*. Born, 1758; died, 1808.
- Amurath I.** Sultan of Turkey; first of the Sultans to make European conquests. Born, 1319; died, 1389.
- Andersen, Hans Christian.** Danish author. *Fairy Tales for Children; The Improvisatore; The Poets' Bazaar*. Born, 1805; died, 1875.
- André, Major John.** English soldier in the American Revolution, hanged as a spy. Born, 1731; died, 1780.
- Anne.** Daughter of James II. Queen of England. Literature flourished in her reign. Born, 1664; died, 1714.
- Antiochus.** King of Syria. "The Great;" invaded Greece; defeated by the Romans. Born, B. C. 237; died, 187.
- Antoinette, Marie.** Queen of Louis XVI. of France. Guillotined. Born, 1755; died, 1793.
- Antonius, Marcus (Mark Antony).** Roman orator and statesman; triumvir with Octavianus and Lepidus. Lover of Cleopatra; defeated at Actium. Born, B. C. 83; died, 36.
- Appius Claudius.** Roman patrician. Decemvir; attempted to dishonor Virginia, daughter of Virginius. Died, B. C. 449.
- Aquinas, Thomas.** Scholastic Italian theologian. Author of *Summa Theologia*, to this day a standard authority in the Roman Catholic Church. His writings fill 17 folio volumes. While a member of the Council of Lyons, fell sick and died at that city. Born, 1226; died, 1274.
- Archimedes.** Syracusan mathematician and engineer; made many discoveries in hydrostatics and mechanics. *On the Sphere and Cylinder*. Born, B. C. 287; died, 212.
- Aristides.** "The Just." Athenian statesman. Rival of Themistocles. Died, B. C. 468.
- Aristophanes.** Greatest Greek comedy writer. *The Knights. The Clouds. The Birds*. Born, B. C. 444; died, 380.
- Aristotle.** Greek philosopher. Father of scientific natural history, and of logic. Tutor of Alexander the Great; taught at Athens in the Lyceum; left works on physics, metaphysics, ethics, dialectics, logic, mathematics, politics, economics. Born, B. C. 384; died, 322.
- Arius.** A noted Catholic theologian, a presbyter of Alexandria in the 4th century. Founder of Arian sect. Born, 280; poisoned, 336.
- Arkwright, Sir Richard.** Noted English inventor. Began life as a barber. Invented the spinning frame. Was mobbed because his machine threatened to interfere with labor. "This man," says Carlyle, "gave to England the power of cotton." Became very wealthy. Born, 1732; died, 1792.
- Arminius, James.** Dutch theologian; founder of Arminianism; denied Calvinistic doctrines of grace and predestination. Born, 1560; died, 1609.
- Arnold, Benedict.** American traitor. Tried to surrender West Point to the British. Born, 1740; died, 1801.
- Arnold, Edwin.** English journalist and poet, editor of the *London Telegraph*. *The Light of Asia; Light of the World*. Born, 1832.
- Arnold, Matthew.** English poet and critic. *God and the Bible; Poems; Essays in Criticism*. Born, 1822; died, 1888.
- Arnold, Thomas.** English educator and historian. Master of Rugby School. *History of Rome*. Born, 1795; died, 1842.
- Arthur, Chester A.** American President; born in Vermont and educated at Union College; admitted to the bar; Quartermaster-General of New York during the Civil War; Collector of the Port of New York, 1871-78; Vice-President, 1881; succeeded to Presidency on death of President Garfield, September, 1881. Born, 1830; died, 1886.
- Ascham, Roger.** Tutor of Queen Elizabeth. *The Schoolmaster; Toxophilus or the School of Shooting*. Born, 1515; died, 1568.
- Astor, John Jacob.** American millionaire; founder of the present Astor family. Born, 1763; died, 1848.
- Attila.** "The Scourge of God." King of the Huns. Invaded the Roman Empire. Died, 453.
- Audubon, John James.** American naturalist. *Birds of America*. Born, 1782; died, 1831.
- Augustine, Saint.** Bishop of Hippo in Africa. Theologian, *De Civitate Dei*. Professor of rhetoric and philosophy at Milan, 384; was for a time immoral, but was converted about 386. Ordained priest 391. He wrote against the Pelagians, the treatises *On the Grace of Christ*, and *On Original Sin*. Born, 354; died, 430.
- Augustus (Octavianus).** First Roman Emperor. Conqueror at Actium, Patron of literature. Born, B. C. 65; died, A. D. 14.
- Aurelian.** Roman Emperor. Conquered Zenobia and annexed her kingdom of Palmyra. Born, 212; died, 275.

Austen, Jane. English novelist. *Sense and Sensibility*; *Pride and Prejudice*; *Emma*. Born, 1775; died, 1817.

Bach, John Sebastian. German composer. *The Nativity*. Produced both secular and sacred music in great variety. Born, 1685; died, 1750.

Bacon, Francis, Viscount St. Albans, Lord Verulam. English statesman and philosopher. *Novum Organum*; *Advancement of Learning*. Counsel to Queen Elizabeth at 28; found guilty of corruption, 1621. Among his works are *Essays*; and *On the Wisdom of the Ancients*. His *Novum Organum* applies inductive method to study of science. Born, 1561; died, 1626.

Baker, Sir Samuel White. Noted English traveler in Africa and India. Wrote five books of travels. Born, 1821; died, 1893.

Balboa, Vasco Nuñez de. Spanish adventurer. Discoverer of the Pacific. Born, 1475; died, 1517.

Baltimore, Lord George Calvert. English statesman. Founder of Maryland. City of Baltimore named for him. Born, 1580; died, 1632.

Balzac, Honoré de. French novelist. *Comedie Humaine*. Born, 1799; died, 1850.

Bancroft, George. American diplomatist and historian. Minister to England, and to Germany; Secretary of the Navy. *History of United States*. Born, 1800; died, 1891.

Barneveldt, Jan van Olden. Dutch statesman, patriot, liberal leader. Beheaded. Born, 1549; died, 1619.

Barnum, Phineas T. American showman. Born, 1810; died, 1891.

Baxter, Richard. English Dissenting minister, writer. *The Saints' Rest*. Born, 1615; died, 1691.

Beauharnais, Alexander, Vicomte de. First husband of the Empress Josephine. Born, 1760; died, 1794.

Becket, Thomas à. Archbishop of Canterbury. Murdered; had controversy in defence of rights of the Church with Henry II. of England, whom he excommunicated. Born, 1117; died, 1170.

Bede, "The Venerable." Anglo-Saxon historian. *Ecclesiastical History of the English Nation*. Born, 672; died, 735.

Beecher, Lyman. American Congregational preacher, and theologian. *Views on Theology*. Born, 1775; died, 1836.

Beecher, Henry Ward. American preacher, lecturer, and orator, at Brooklyn, N. Y. *Star Papers*. Born, 1813; died, 1887.

Beethoven, Louis von. German composer. *Ninth Symphony*. For a time organist to the Elector of Cologne; settled in Vienna, where he produced (1802) his *Sinfonia Eroica*. In 1805 appeared his opera of *Lenore*. He composed many symphonies, cantatas, and overtures. Born, 1770; died, 1827.

Bell, A. G. American inventor. Inventor of the Bell telephone. Born, 1847.

Bennett, James Gordon. American journalist. Proprietor of the *N. Y. Herald*. Born, 1795; died, 1872.

Berlichingen, Goetz von ("The Iron-Handed"). German hero. Immortalized by Goethe. Slain

in war of peasants against nobles. Born, 1480; died, 1562.

Bernard, Saint. Abbot of Clairvaux. French ecclesiastic. Born at Dijon, in Burgundy. He was active in bringing about the crusade of 1146; canonized in 1174. Born, 1091; died, 1153.

Bernhardt, Sarah. The most noted French actress of modern times, if, indeed, she may not be called the most famous actress of all time. She traveled over the countries of Europe and America a number of times, always rendering her plays in the French language, yet commanding higher prices than any other person on the stage, the popular prices for choice seats in 1900-1901 in New York and Philadelphia being \$10 to \$25. Born, 1844.

Besant, Sir Walter. English novelist. Eminent chiefly for the healthy realistic type of his work. Champion of the cause of Authors versus Publishers. Born, 1838; died, 1901.

Bismarck, Otto von. German statesman; 1847, member United Diet and leader of Conservatives; ambassador to Russia, 1809; Prime Minister of Prussia, 1862; Chancellor of the German Empire. Born, 1813; died, 1898.

Black, William. Scotch novelist; originally a journalist. *A Daughter of Heth*; *Strange Adventures of a Phaeton*; *A Princess of Thule*; *Madcap Violet*. Born, 1841; died, 1899.

Black Hawk. Indian chief. Hero of the Black Hawk War. Born, 1768; died, 1838.

Blackstone, Sir William. English judge, and law writer. *Commentaries*. Born, 1723; died, 1780.

Blaine, James Gillespie. American Republican politician; U. S. Senator from Maine; Speaker, House Representatives; Secretary of State. Born, 1830; died, 1893.

Blake, Robert. Great English admiral and sea king. Annihilated Spanish fleet in Santa Cruz Bay. Born, 1598; died, 1657.

Blücher, Gebhard L. von. Prussian field marshal; decided the battle of Waterloo by coming with his force in the evening. Born, 1742; died, 1819.

Boleyn, Anne. 2d Queen of Henry VIII. Beheaded. Born, 1507; died, 1536.

Bolivar, Simon. Liberator of the Spanish South American colonies. Born, 1783; died, 1830.

Bonaparte, Caroline M. A. Sister of Napoleon I. Wife of Murat. Born, 1782; died, 1839.

Bonaparte, Jerome, born, 1784; died, 1860. Joseph, born, 1766; died, 1844. Louis Napoleon, born, 1778; died, 1846. Brothers of Napoleon. Kings respectively of Westphalia, Spain, Holland.

Bonaparte, Maria Letitia. Mother of Napoleon I. Born, 1750; died, 1836.

Bonaparte, Napoleon. Napoleon I. Emperor of France. Captain of Artillery, 1792; crushed insurrection in Paris, 1795; married Josephine Beauharnais, and took command of the army of Italy, 1796; conquered Austria and the Pope, 1797; made an expedition to Egypt, 1798; made First Consul, 1799; conquered at Marengo, 1800; made peace with England, 1802, and about this time produced his *Civil Code*. Became Emperor, 1804; engaged in war with England, Russia, Sweden, Prussia; married Marie Louise,

- 1810; made a disastrous campaign in Russia, 1812; was beaten at Leipzig, 1813; retired to Elba, 1814; returned to France, and was conquered at Waterloo, and sent to St. Helena, 1815. Born, 1769; died, 1821.
- Bonheur, Rosa.** Celebrated French painter of animals. Born at Bordeaux. Brought up in poverty. Taught by her father. Best known works "The Horse Fair" and "Hay Harvest in Auvergne." "Ploughing with Oxen" is her masterpiece. Born, 1822; died, 1900.
- Boniface VIII.** Pope; 1294-1303. Excommunicated Philip the Fair of France. Born, 1228; died, 1303.
- Boone, Daniel.** American explorer and hunter. Father of the present State of Kentucky. Born, 1735; died, 1820.
- Booth, Edwin.** American actor. Among his best parts are *Richelieu*, *Iago*, *Hamlet*, and *Berbuccio* in the *Fool's Revenge*. Born, 1833; died, 1893.
- Booth, Junius Brutus.** English tragedian. Great in Shakespearian parts, especially *Richard III.*; came to America. Father of Edwin and John Wilkes. Born, 1796; died, 1852.
- Booth, William.** Great English evangelist. Founder and general of the Salvation Army. Born, 1839.
- Borgia, Cæsar.** Italian soldier and statesman. Just as a ruler in his own domain, but crafty and cruel personally. A patron of art and literature. Son of Pope Alexander VI. Born, 1476; died, 1507.
- Boswell, James.** Scotch biographer of Dr. Johnson. *Boswell's Life of Johnson*. Born, 1740; died, 1795.
- Bowdoin, James.** American statesman. Governor of Massachusetts. Founder of Bowdoin College. Born, 1727; died, 1790.
- Braddock, Edward.** British general in America. Defeated by Indians. Born, 1715; died, 1755.
- Breckenridge, John C.** American politician. Vice-President (1857-1861). Confederate general. A Democratic candidate for President, 1860. Born, 1821; died, 1875.
- Bright, John.** English Radical, statesman, and orator. Opponent of Corn Laws; member of Gladstone's cabinet. Born, 1811; died, 1889.
- Brontë, Charlotte.** "Currer Bell." English novelist; 1848, *Jane Eyre*; 1849, *Shirley*; 1852, *Villette*; 1854, married Rev. Arthur B. Nichols. Born, 1816; died, 1855.
- Brown, John.** American abolitionist leader. Captured by Robert Lee, at Harper's Ferry, tried and hanged as a conspirator. Born, 1800; died, 1859.
- Browne, Charles F.** "Artemus Ward." American humorous writer. Born, 1835; died, 1867.
- Browning, Mrs. Elizabeth Barrett.** English poetess; wrote verses at ten; *The Drama of Exile*; 1844, *Poems*; 1856, *Aurora Leigh*; married Robert Browning in 1846. Born, 1809; died, 1861.
- Browning, Robert.** English poet. Among his works are *Pippa Passes*; *The Blood on the 'Scutcheon*; *The Red-Cotton Night-Cap Country*, and *Idyls*. Born, 1812; died, 1889.
- Brownlow, William G.** American journalist and politician; Governor of Tennessee; U. S. Senator. Born, 1805; died, 1877.
- Bruce, Robert.** King of Scotland. Defeated Edward II. at Bannockburn, 1314. Born, 1274; died, 1329.
- Brummell, George B.** "Beau Brummell." English man of fashion. Born, 1778; died, 1840.
- Brutus, Lucius Junius.** Roman patriot; overthrew Tarquin and established Republican government at Rome. Flourished 6th century, B. C.
- Brutus, Marcus Junius.** One of Cæsar's assassins. Defeated at Philippi. Committed suicide. Born, B. C. 85; died, 42.
- Bryan, William Jennings.** American statesman, born in Salem, Illinois; entered Congress in 1890 as an extreme Free Silver man; was twice nominated for the Presidency in opposition to Mr. McKinley, but defeated in 1896 and again in 1900. Born, 1860.
- Bryant, William Cullen.** American poet. *Thanatopsis*. Born in Massachusetts; at 13 wrote *The Embargo* and *The Spanish Revolution*; published *The Ages*, 1821; became an editor of the *New York Evening Post* in 1826; *Translation of Homer*, 1867. Born, 1794; died, 1878.
- Buchanan, James.** American president; born in Pennsylvania; admitted to bar, 1812; M. C., 1821-31; minister to Russia, 1832-4; U. S. Senator, 1834-45; Secretary of State, 1845-9; minister to England, 1852-6; signed Ostend Manifesto, 1854; President, 1857-61. Born, 1791; died, 1868.
- Bunyan, John.** English author. *Pilgrim's Progress*; *The Holy City*; *The Holy War*. For several years led a dissipated, wandering life; joined Anabaptists in 1654; became Baptist minister, 1655; in prison, 1660-72; there wrote part of *Pilgrim's Progress* (1678); after his release, was minister at Bedford. Born, 1628; died, 1688.
- Burr, Aaron.** American lawyer and statesman; Vice President. Tried for (and acquitted) of treason. Killed Alexander Hamilton in a duel. Born, 1756; died, 1836.
- Butler, Benjamin F.** American lawyer, politician and general; member of Congress; military governor of New Orleans. Born, 1818; died, 1892.
- Byron, George Gordon, Lord.** English poet. *Childe Harold*, *Don Juan*; *Cain*; *Manfred*; *Marino Faliero*; *The Two Foscari*; *Beppo*; *The Vision of Judgment*; *The Prisoner of Chillon*; *The Siege of Corinth*; *Mazeppa*; *English Bards, and Scotch Reviewers*; *Parisina*; *The Deformed Transformed*. Born, 1788; died, 1824.
- Cæsar, Caius Julius.** Roman general and statesman. Dictator. Quæstor, 58 B.C.; ædile, 65; pontifex maximus, 64; consul, 59 (alliance with Pompey and Crassus called first triumvirate); was granted both the Gauls for 5 years; conquered many tribes, and invaded England; crossed Rubicon and entered Rome; conquered Pompey at Pharsalia (48); subdued Spain and Africa; made imperator; assassinated by Brutus, Cassius, and others. Born, B. C. 99; died, 44.

- Cable**, George W. American novelist. *Old Creole Days*, *The Grandissimes*, *John March, Southerner*. Born, 1844.
- Caine**, Thomas Henry Hall. English novelist. *The Deemster*, *The Manxman*, *The Christian*. Born, 1853.
- Calhoun**, John Caldwell. American statesman. Vice-President. Native, South Carolina; elected to Congress, 1810; Secretary of War, 1817; Vice-President, 1829-32; resigned in latter year and entered Senate; Secretary of State, 1844; re-entered Senate, 1845; "State's Rights" leader; left, among other writings, a *Treatise on the Nature of Government*. Born, 1783; died, 1850.
- Caligula**. Emperor of Rome (37-41). Insanely cruel, sensual, impious. Built temple to himself. Born, 12; died, 41.
- Calvert**, Cecilius. Second Lord Baltimore; was first proprietor of Maryland. Especially distinguished as one of the pioneers of civil and religious liberty. Born, —; died, 1676.
- Calvin**, John. French theologian. The fundamental doctrines of his theology were unconditional reprobation and election. He published *Commentaries on the Harmony of the Gospel*. Born, 1509; died, 1564.
- Campbell**, Alexander D. P. Born in Ireland. Founder of the religious sect known as Campbellites, but calling themselves "The Christian Church." Founded Bethany College, Va. Born, 1788; died, 1866.
- Camoens**, Luis or Luiz. The greatest of Portuguese poets. *The Lusiad* and other poems of rare merit. So neglected and died in such poverty that he has been called *the glory and shame of Portugal*. Born, 1517; died, 1579.
- Campbell**, Thomas. Scotch poet. Son of a Glasgow merchant. *Pleasures of Hope*, *Exile of Erin*, *Ye Mariners of England*, *Lochiel's Warning*. Born, 1777; died, 1844.
- Canning**, George. English statesman and orator. Prime Minister; 1807, Secretary for foreign affairs; fought duel with Castlereagh; premier, 1827. Born, 1770; died, 1827.
- Canova**, Antonio. Italian sculptor. Among his works are *Venus and Adonis*, *The Graces*, and a statue of Washington. Born, 1757; died, 1822.
- Canute II**. King of Denmark and conqueror of England in 1016. Governed his three kingdoms of Denmark, Norway and England with great firmness and prudence. Born, about 985; died, 1036.
- Caprivi**, George Leo Graf von. German statesman. In Prussian army 1849-1890. Succeeded Bismarck as chancellor and prime minister in 1890. Born, 1831; died, 1899.
- Carleton**, Will. American poet. *Farm Ballads*. Born 1845.
- Carlyle**, Thomas. Scotch historian and essayist. Published *Sartor Resartus*, 1834; *French Revolution*, 1837; *Chartism*, 1839; *Heroes and Hero Worship*, 1840; *Past and Present*, 1843; *Latter Day Pamphlets*; *Oliver Cromwell's Letters and Speeches*, 1845; *Life of John Sterling*, 1851; *Life of Frederick the Great*, 1858-64. Born, 1795; died, 1881.
- Carnegie**, Andrew. American manufacturer and capitalist, of Scotch birth. Grew immensely wealthy in the iron and steel business. Withdrew in 1901 with fortune of \$250,000,000. Gave many million dollars to found libraries and schools. *Triumphant Democracy*. Born, 1835.
- Carnot**, Marie Francois Sadi. President of France. Grandson of Lazare Carnot, prominent in the Revolution and Empire. In National Assembly, 1871; finance minister, 1881 and 1887; elected President in 1887; assassinated by an anarchist. Born, 1837; died, 1894.
- Castelar**, Emilio. Spanish statesman and author. Active in the Cortes; dictator in 1873; withdrew from political life 1893. Wrote historical and political works. Born, 1832.
- Carroll**, Charles (of Carrollton). American Revolutionary statesman. Signer of the Declaration of Independence. Very wealthy. Born, 1737; died, 1832.
- Cartwright**, Edmund. English inventor. Parliament voted him 10,000 pounds for inventing the power loom. Born, 1743; died, 1823.
- Cass**, Lewis. American statesman and diplomatist. U. S. Senator from Michigan. Democratic candidate for President, 1840; Secretary of State. Born, 1782; died, 1866.
- Catherine of Aragon**. Queen of Henry VIII. of England. Divorced. Born, 1486; died, 1536.
- Catherine de Medici**. Queen of Henry II. of France. Strenuous opponent of Protestantism and the Huguenots. Instigated the "Massacre of St. Bartholemew." Born, 1519; died, 1589.
- Catherine I**. Wife of Peter the Great. Empress of Russia; succeeded to government on his death. Born, 1682; died, 1727.
- Catherine II**. Empress of Russia; often called "The Great." Born, 1729; died, 1796.
- Cato**, Marcus Portius. Opponent of Cæsar; famed for probity. Committed suicide. Born, B. C. 95; died, 46.
- Cavour**, Camillo B. Count. Famous Italian statesman. First Prime Minister to the Kingdom of Italy. Born, 1810; died, 1861.
- Caxton**, William. English scholar and merchant. Distinguished for introducing printing into England. Born, 1412; died, 1492.
- Cecil**, William, Lord Burleigh. Lord Treasurer of England, under Elizabeth. Born, 1520; died, 1598.
- Cervantes Saavedra**, Miguel. Spanish novelist and satirist. *Don Quixote*. Born, 1547; died, 1616.
- Chalmers**, Thomas. Scotch preacher and theologian. Founder of the "Free Church" in Scotland. *Astronomy in its Connection with Religion*. Born, 1780; died 1847.
- Chamberlain**, Joseph. English Radical statesman; President of the Board of Trade; Colonial Secretary during the Boer War. Born, 1836.
- Chambers**, Robert. Scottish editor, author, and publisher. With his brother, William, editor of *Chambers' Journal*, *Chambers' Encyclopedia*, *Chambers' Book of Days*. Born, 1802; died, 1872.

- Chambers, William.** Brother, partner, and co-laborator with above. Born, 1800; died, 1885.
- Channing, William Ellery.** American Unitarian theologian and reformer; opponent of slavery. *Self-Culture; The Elevation of the Laboring Classes; Evidences of Christianity.* Born, 1780; died, 1841.
- Charlemagne.** King of France. Emperor of the West. Son of Pepin the Short; became master of the whole territory of the Franks in 771; crowned Emperor of the West, with the title of Cæsar Augustus, by Pope Leo III., 800. His empire extended from the Elbe to the Ebro, and from Calabria to Hungary. He was the founder of the Carolingian line of kings. Born, 742; died, 814.
- Charles V. (I. of Spain).** Emperor of Germany and King of Spain; summoned the Diet of Worms to put down Luther in 1521; opposed the Protestants, but made concession to them by the treaty of Passau 1552; abdicated 1552, and withdrew to the monastery of St. Yuste, Spain. Born, 1500; died, 1558.
- Charles XII.** King of Sweden, 1697-1718. Soldier and conqueror. Peter the Great of Russia, Frederick IV. of Denmark, and Augustus of Poland made a league against him in 1700. He besieged Copenhagen, and forced Denmark to make peace; beat the Russians, and in the next campaign invaded Poland, where he compelled Augustus to resign; invaded Russia, and was defeated (1709) at Pultowa; found refuge in Turkey, from which he soon returned; invading Norway, he was killed at the siege of Frederickshalle. Born, 1682; died, 1718.
- Charles the Bold.** Duke of Burgundy. Warred with Louis XI. of France and Rene of Lorraine; killed fighting the Swiss allies of the latter. Born, 1433; died, 1477.
- Chase, Salmon P.** American statesman and jurist. Secretary of the Treasury. Chief Justice of the U. S. Born, 1808; died, 1873.
- Chateaubriand, Francis A., Viscount of.** French poet and prose writer. *Genie du Christianisme. Atala.* Born, 1768; died, 1848.
- Chatham, William Pitt, First Earl of.** English statesman and orator. "The Great Commoner;" entered Parliament, 1735; opposed Walpole's ministry; Premier, 1757; opposed taxation of the American Colonies. Born, 1708; died, 1778.
- Chaucer, Geoffrey.** English poet. *The Canterbury Tales; The Court of Love; Legend of Good Women; Troilus and Cresseide.* Born, 1328; died, 1400.
- Cherubini, Maria L. C. Z. S.** Italian musical composer. Among his works are *Medee, Elisa, Ali Baba*, and, in sacred music, the *Requiem*. Born, 1760; died, 1842.
- Chesterfield, Philip D. Stanhope.** English orator and wit. Noted for his exquisite manners, on which subject he was the oracle of his day. Born, 1694; died, 1773.
- Child, Lydia Maria.** American author and philanthropist. Editor "National Anti-slavery Standard." Born, 1802; died, 1880.
- Childs, George W.** American publisher and philanthropist. Noted for his honesty and benefactions. Born, 1829; died, 1896.
- Choate, Rufus.** American lawyer, orator, and statesman. Most eloquent advocate of his time; U. S. Senator from Massachusetts. Born, 1799; died, 1859.
- Chopin, Frederick.** Polish composer and pianist. His works are perhaps the best of piano music. Born, 1810; died, 1849.
- Cicero, Marcus Tullius.** Roman orator, statesman, and author. In his consulship suppressed the conspiracy of Catiline; went in exile in 58 B. C. but was recalled; was a Pompeian, but enjoyed the favor of Cæsar; was slain by soldiers under orders from Antony. His work *On Old Age* is perhaps the best known of his writings. Born, B. C. 103; died, 46.
- Clay, Henry.** American orator and statesman. Born in Virginia; Speaker of U. S. Congress, 1811; signed treaty of Ghent, 1815; elected Speaker, 1815, and thrice re-elected; Secretary of State, 1825; U. S. Senator, 1832-42; Whig candidate for President, 1844; re-elected to Senate, 1848. Born, 1777; died, 1852.
- Clemens, Samuel L.** American humorist, who under the pen name of "Mark Twain" contributed the richest humor of the century; *The Innocents Abroad; Following the Equator.* Born, 1835.
- Cleopatra.** Queen of Egypt. Joint sovereign of Egypt with her brother Ptolemy; was beautiful and accomplished, but voluptuous; lived with Cæsar at Rome (46-44); in 41, became the favorite of Mark Antony; at the battle of Actium she fled; escaped Augustus by killing herself with an asp. Born, B. C. 69; died, 30.
- Cleveland, Grover.** Twenty-second President of the United States. Born at Caldwell, New Jersey; went to Buffalo, and was admitted to the bar in 1859. In 1881 he was elected Mayor of Buffalo, and in 1882 became Governor of New York. He served two terms as President of the United States, 1885-1889 and 1893-1897, being defeated for the intervening term by Benjamin Harrison, the Republican candidate. Born, 1837.
- Clinton, DeWitt.** American statesman. Governor of New York; U. S. Senator; Federal candidate for President; promoter of the Erie Canal. Born, 1769; died 1828.
- Cobden, Richard.** English statesman and economist. Leader of the Anti-Corn Law League. Born, 1804; died, 1865.
- Coleridge, Samuel Taylor.** English poet and philosopher. *The Ancient Mariner*; with Wadsworth wrote *Lyrical Ballads*; published *Christabel; Biographia Literaria; Aids to Reflection*; was a slave to opium. Born, 1772; died, 1834.
- Coligny, Gaspard de.** French admiral. Huguenot leader; killed in the massacre of St. Bartholomew. Born, 1517; died, 1572.
- Colt, Samuel.** American inventor; Colt's revolver. Born, 1814; died, 1862.
- Columbus, Christopher.** Discoverer of America. Born in Genoa; expected by sailing westward to find India; left Palos (Aug. 3, 1492) with 3

- vessels; discovered San Salvador Oct. 12; visited Cuba and Hayti; 1493 discovered Porto Rico and Jamaica; 1498 continent at mouth of Orinoco; 1502 Honduras; died in poverty and neglect. Born, 1436; died, 1506.
- Comte, Auguste.** French philosopher. Founder of Positivism. *Course of Positive Philosophy*. Born, 1798; died, 1857.
- Confucius, (Kung-futse).** Chinese philosopher and theologian. Came forward as a religious teacher at 22. His philosophy related to the present life only; had nothing to do with physics or metaphysics. His influence in the East has been enormous. Born, B. C. 551; died, 479.
- Conger, Edwin H.** American diplomatist. Congress, 1885-1891; Minister to Brazil, 1891-1895; to China, 1898. Rescued from "Boxer" siege in 1900 by allied forces. Born, 1843.
- Conkling, Roscoe.** American Republican, lawyer, and statesman. U. S. Senator from New York. Born, 1828; died, 1888.
- Constantine I. ("The Great").** Roman Emperor (306-337). Removed the Capital of the Empire to Byzantium. Born, 272; died, 337.
- Cook, Captain James.** English circumnavigator of the globe, and discoverer. Killed by Hawaiians. Born, 1728; died, 1779.
- Cooper, Peter.** American philanthropist. Founder of Cooper Union. Born, 1791; died, 1883.
- Cooper, James Fennimore.** American novelist. Among his works are *The Spy*, *The Pioneers*, *The Pilot*, *The Red Rover*, *The Last of the Mohicans*, *The Pathfinder*, *The Deerslayer*. Born, 1789; died, 1851.
- Cope, Edward Drinker.** American naturalist and comparative anatomist. One of the foremost palæontologists of the world. Editor *American Naturalist*. Born, 1840; died, 1897.
- Copernicus, Nicholas.** German astronomer. Demolished the Ptolemaic theory of the universe and demonstrated that the sun is the center of the universe in his great work *The Revolution of the Celestial Orbs*. Born, 1473; died, 1543.
- Corday, Charlotte de.** Slayer of Marat. Born, 1768; died, 1793.
- Corelli, Marie.** English novelist. A step-daughter of Charles Mackay, the poet. *Romance of Two Worlds*, *Barabbas*, *The Sorrows of Satan*. Born, 1864.
- Cornell, Ezra.** American philanthropist. Founder of Cornell University. Born, 1807; died 1874.
- Cortez, Hernando.** Spanish conqueror of Mexico. Born, 1485; died, 1547.
- Cornwallis, Charles.** Noted British general. Surrendered to George Washington at Yorktown, 1781, thus practically closing the War for Independence. Born, 1738; died, 1805.
- Cowper, William.** English poet. Published his great work, *The Task*, in 1785. His letters are among the best in the language. Born, 1731; died, 1800.
- Crane, Stephen.** American author. *The Red Badge of Courage*, and other stories. Also noted war correspondent in 1898. Born, 1871; died, 1900.
- Crawford, F. Marion.** American novelist. Nephew of Julia Ward Howe. *Mr. Isaacs*, *Paul Patoff*, etc. Born, 1854.
- Cranmer, Thomas.** Archbishop of Canterbury. Reformer. Burnt as a Christian martyr. Born, 1489; died, 1556.
- Crispi, Francesco.** Italian statesman. A revolutionist with Garibaldi; Prime Minister of Italy 1887-90 and 1894. Born, 1819.
- Crockett, David.** American pioneer and hunter, famous for his bravery and eccentricities. Served several years in Congress; joined the Texan patriots in 1836 and was massacred by Mexicans at the Alamo. Born 1786; died, 1836.
- Cræsus.** King of Lydia. Famous for his wealth. Born, B. C. 590; died, 546.
- Cromwell, Oliver.** Lord Protector of England. Entered army as captain of cavalry, 1642; signed death warrant of Charles I., 1649; routed the Scotch at Dunbar, beat Charles at Worcester, 1651; dissolved Parliament, 1653; was created Protector, 1654. Born, 1599; died, 1658.
- Cruikshank, George.** English caricaturist. *Comic Almanack*. Born, 1792; died, 1878.
- Curtis, George William.** American orator, author and journalist. *Nile Notes*; *Potiphar Papers*. Born 1824; died, 1892.
- Cushing, Caleb.** American lawyer, diplomatist and statesman. Attorney-General of the United States; Minister to China. *The Treaty of Geneva*. Born, 1800; died, 1879.
- Cushman, Charlotte S.** American actress. Great as *Meg Merrilies*. Born, 1816; died, 1876.
- Cuvier, George C. L. D., Baron de.** French naturalist. *Animal Kingdom*, *Natural History of Fishes*; was founder of the science of comparative anatomy. Born, 1769; died, 1832.
- Cyrus, The Great.** Founder of the Persian Empire and greatest of Persian kings. Killed in battle 529 B. C.
- Dallas, George M.** American Democratic politician. Vice-President, 1845-49. Born, 1792; died, 1864.
- Dalton, John.** English natural philosopher. Propounder of the atomic theory. *New System of Chemical Philosophy*. Born, 1766; died, 1844.
- Dana, Charles A.** American journalist. Editor of the *New York Sun*. Born, 1819; died, 1898.
- Dana, Richard Henry.** American poet and man of letters. *The Buccaneer*, *The Dying Rover*, *The Idle Man*. Born, 1787; died, 1879.
- Dana, Richard Henry.** Son of the above. American lawyer and author. *Two Years Before the Mast*. Editor of *Wheaton's International Law*. Born, 1815; died, 1882.
- Daniel.** One of the four greater Hebrew prophets. Taken prisoner by Nebuchadnezzor. Highly honored by Kings Darius and Cyrus.
- Dante degli Alighieri.** Greatest Italian poet. *The Divine Comedy*. Passed much of his time in exile from Florence for political causes. Wrote *The New Life (Vita Nuova)*, the *Convito*, treatise on the Italian language, *De Vulgari Eloquentia*, and *De Monarchia*. Born, 1265; died, 1321.

- Danton**, George J. French Revolutionist. Head of the "Dantonists." Minister of Justice. Guillotined. Born, 1759; died, 1794.
- Darius I.** (Hystaspes). King of Persia. B. C., 521-485. Began the wars with the Greeks. His Satraps Datis and Artaphernes were defeated at Marathon. Born, B. C. —; died, 485.
- Darius III.** (Codomannus). King of Persia. B. C. 336-330. Defeated and dethroned by Alexander the Great. Born, B. C. 380; died, 330.
- Darwin**, Charles R. English naturalist. Originator of the theory of evolution by natural selection. *Origin of Species*; *The Descent of Man*; *The Fertilization of Orchids*. Born, 1809; died, 1882.
- David**. King of Israel. Distinguished as general, statesman, poet and prophet. Lived 1090 to 1055 B. C.
- Da Vinci**, Leonardo. Italian painter, sculptor, engineer and universal genius. *The Lord's Supper*. Among his works are *Madonna*, *Lisa del Giocondo* and *The Virgin on the Knees of St. Anne*. Born, 1452; died, 1519.
- Davis**, Jefferson. American statesman; colonel in Mexican war, elected to U. S. Senate, 1847; Secretary of War, 1853-57; re-elected to Senate, 1857; President Southern Confederacy, 1861-65. Born, 1808; died, 1889.
- Davis**, Rebecca Harding, and her son, *Richard Harding*. American novelists. The latter also a spirited war correspondent in Cuba, 1898, and South Africa, 1900. Born, first, 1831; second, 1864.
- Dawson**, Sir J. William. Canadian geologist. An original investigator, writer, and teacher. Born, 1820; died, 1899.
- Davy**, Sir Humphrey. An English chemist of great eminence. President of the Royal Society; author many valuable scientific works. Born, 1778; died, 1829.
- Decatur**, Stephen. American naval officer. Distinguished himself in Tripoli, 1804, and in War of 1812 with England. Killed in duel. Born, 1779; died, 1820.
- DeFoe**, Daniel. English novelist. Produced his great work, *Robinson Crusoe*, in 1719; *Moll Flanders*, 1721; *Colonel Jack*, 1721. Born, 1661; died, 1731.
- Demosthenes**. Greatest Greek orator. Was an opponent of Philip of Macedon, against whom, between 352 and 340 B. C., he delivered his 11 *Phillipics*. It being proposed to give him a crown, Æschines opposed; this was the cause of the noblest speech of Demosthenes, that *On the Crown*. Born, B. C., 385; died, 322.
- Depew**, Chauncey M. American railway director, politician, and humorous orator; elected U. S. Senator in 1899. Born, 1834.
- DeQuincey**, Thomas. English author. Contracted opium habit. *Confessions of an Opium Eater*. Born, 1785; died, 1859.
- Descartes**, René. French philosopher and metaphysician. *Principles of Philosophy*; made many discoveries in algebra and geometry. Born, 1596; died, 1650.
- Dewey**, George. Admiral American Navy; hero of battle of Manila (1898); triumphant return to America in 1899. Born, 1837.
- Dickens**, Charles. English novelist. Published *Sketches by Boz*, 1836; *Pickwick Papers*, *Oliver Twist*, *Nicholas Nickelby*, *The Old Curiosity Shop*, etc. Born, 1812; died, 1870.
- Diogenes**. Greek cynic philosopher. Surly and independent inhabitant of a tub. Born, B. C., —; died, 323.
- Disraeli**, Benjamin, Earl of Beaconsfield. English statesman and novelist. Premier (1874-1880). *Coningsby*, *Vivian Grey*, *Henrietta Temple*, *Endymion*, *Lothair*. Born, 1805; died, 1881.
- Donnelly**, Ignatius. American author and politician. Nominated for Vice-President People's Party ticket, 1900. *The Great Cryptogram*, *Cæsars Column*, etc. Born, 1831; died, 1901.
- Dore**, Gustave. French painter and illustrator. Illustrated Dante's *Inferno*, *Don Quixote*, *Paradise Lost*, *Idylls of the King*, etc. Painted *Francesca de Rimini*, *Christ Leaving Prætorium*, etc. Born, 1832; died, 1883.
- Douglas**, Stephen A. American Democratic politician. Senator from Illinois. *The Kansas-Nebraska Bill*. Born, 1813; died, 1861.
- Draco**. Athenian legislator. Noted for the severity of his laws. Born, B. C. 7th century.
- Drake**, Sir Francis. English navigator and admiral. Preyed upon Spanish commerce; burned 100 Spanish vessels in Cadiz. Born, 1545; died, 1596.
- Dreyfus**, Albert. A French army officer. Persecuted because of his Jewish blood, as the scapegoat for criminal officers. Sentenced to perpetual imprisonment, 1894, but secured new hearing and was pardoned, 1899.
- Drummond**, Henry. British author and teacher. *Natural Law in the Spiritual World*, *The Ascent of Man*, *The Greatest Thing in the World*, etc. Born, 1851; died, 1897.
- Dryden**, John. English poet and dramatist. Appointed poet-laureate, 1670; produced *Absalom and Achitophel*, *Ode on Alexander's Feast*, *Fables*. Of his dramatic works, *All for Love* is the best. Born, 1631; died, 1700.
- Dumas**, Alexandre. French novelist. *The Three Musketeers*. Born, 1803; died, 1870.
- Dumas**, Alexandre (Jr.). French novelist and dramatist. *La Dame aux Camélias*. Born, 1824.
- Du Maurier**, George L. P. B. Born in Paris; satirical illustrator for *Punch*; novelist. *Peter Ibbetson*, *Trilby*. Born, 1834; died, 1896.
- Eads**, James Buchanan. American engineer. Built the St. Louis bridge; deepened the channel of the Mississippi. Born, 1820; died, 1887.
- Ebers**, George Moritz. German Egyptologist and writer. *An Egyptian Princess*, *Homo Sum*, *Cleopatra*. Born, 1837; died, 1898.
- Eddy**, Mary Baker Glover. American theologian. Founder of Christian Science. Author of *Science and Health*, etc.
- Edison**, Thomas Alva. A celebrated American inventor. Born at Milan, Ohio; started life as a newsboy; made important inventions in telegraphy, electric lighting, etc. Also invented the phonograph. Born, 1847.

- Edward VII.** King of England. Succeeded Queen Victoria in 1901. Born, 1841.
- Edwards, Jonathan.** American metaphysician. Ablest defender of Calvinism. *On the Freedom of the Will*. Born, 1703; died, 1758.
- Eggleston, Edward.** American novelist and historian; Minister of Methodist Church. *The Hoosier Schoolmaster*, and several historical works. Born, 1837.
- Eliot, John.** *The Apostle of the Indians*. American preacher and missionary to the Indians. Translated the Bible into Indian language. Born, 1604; died, 1690.
- Elizabeth.** Queen of England. Daughter of Henry VIII. Among the great events of her reign were the repulse of the Spanish Armada, and the execution of Mary Queen of Scots. Born, 1523; died, 1603.
- Emin Pasha.** An African explorer, of German birth; original name Edward Schnitzler. Entered the Egyptian service; governor of the equatorial province, 1878; cut off from world by the Mahdi outbreak; rescued by Henry M. Stanley in 1889; killed by Arabs in later travels. Born, 1840; died, 1892.
- Emerson, Ralph Waldo.** American transcendental philosopher and poet. Was for a time a Unitarian minister in Boston; *English Traits, The Conduct of Life, Poems, Society and Solitude, Essays*. Born, 1803; died, 1882.
- Emmett, Robert.** Irish patriot; Executed for treason. Born, 1780; died, 1803.
- Epictetus.** Greek Stoic philosopher and moralist. *Enchiridion*. Flourished in 2d century.
- Epicurus.** Greek philosopher. Founder of the Epicureans. Born, B. C. 342; died, 270.
- Erasmus, Desiderius.** Noted Dutch scholar. One of the most profoundly learned men of modern times. In 1570 became professor of Divinity and Greek at Cambridge. Works published in ten folio volumes. Born, 1465; died, 1536.
- Eric the Red.** Scandinavian navigator. Supposed to have discovered Greenland about 982, and his son, Lief Eric, is supposed to have visited New England about 1000.
- Ericsson, John.** Swedish engineer and inventor. In 1836 patented the first successful screw propeller. Immigrated to America. In 1861 built the iron-clad *Monitor*, revolutionizing the construction of warships. Born, 1803; died, 1889.
- Euclid.** Alexandrian mathematician. *Elements of Geometry*. Born B. C., 4th century.
- Eugene, Francis, Prince of Savoy.** One of the greatest generals of his time; co-operated with Marlborough at Blenheim, Oudenarde, and Malplaquet. Born, 1663; died, 1736.
- Euripides.** Third in merit of the great Greek tragedy writers. *Alcestis*. Born, B. C. 480; died, 406.
- Evans, Marian (George Eliot).** English novelist. *Scenes of Clerical Life, Adam Bede, The Mill on the Floss, Romola, Middlemarch*, etc. Born, 1820; died, 1880.
- Evarts, William M.** American lawyer and statesman. Attorney-General of the United States; Secretary of State. Born, 1816; died, 1901.
- Everett, Edward.** American orator, statesman and diplomatist. U. S. Senator; Minister to Great Britain. *Orations and Speeches*. Born, 1794; died, 1865.
- Ezekiel.** One of the four greater Hebrew prophets. Contemporary and fellow-prisoner in Babylon with Daniel. Lived about 600 B. C.
- Faraday, Michael.** English man of science. Founder of the science of magneto-electricity. *Experimental Researches in Electricity*. Born, 1791; died, 1867.
- Farragut, David Glascoe.** American Admiral. Entered navy 1812; commander, 1841; passed New Orleans forts and took New Orleans, 1862; made Rear Admiral same year; attacked defenses at Mobile, 1864; Admiral, 1866. Born, 1801; died, 1870.
- Fahrenheit, Gabriel D.** German natural philosopher. Fahrenheit's thermometer. Born, 1686; died, 1736.
- Fawkes, Guy.** An English conspirator. Principal in the Gunpowder Plot to blow up the House of Parliament. Executed 1606.
- Fenelon, Francois de Salignac.** Noted French archbishop, author and orator. Among his works are *Telemachus, Maxims of the Saints, Dialogues on the Eloquence of the Pulpit*, etc. Born, 1651; died, 1715.
- Fessenden, William Pitt.** American Republican Senator, and Secretary of the Treasury. Born, 1806; died, 1869.
- Field, Cyrus W.** American capitalist. Laid the first Atlantic cable. Born, 1819; died, 1892.
- Fielding, Henry.** English novelist. *Tom Jones, Joseph Andrews, Jonathan Wild, Amelia*. Born, 1707; died, 1754.
- Fillmore, Millard.** American President, 1850-53. Born in New York; learned fuller's trade; studied law; member of Congress, 1832-42; elected Vice-President, 1848; became President on death of Taylor. Born, 1800; died, 1874.
- Fish, Hamilton.** American statesman. U. S. Congressman and Senator. Governor New York, 1847; Secretary of State under U. S. Grant, 1869 to 1877. Born, 1808; died, 1895.
- Foote, Andrew Hull.** American Rear-Admiral. Distinguished in Civil War. Born, 1806; died, 1863.
- Ford, Paul Leicester.** American author. *The Hon. Peter Sterling, Janice Meredith*, and *Biographies of Washington and Franklin*. Born, 1865.
- Forrest, Edwin.** American tragedian. Eminent as *Metamora, the Gladiator, Virginius*. Born, 1806; died, 1872.
- Fox, Charles James.** English orator and statesman. Entered Parliament, 1768, as a Tory; opposed policy of Pitt. Born, 1749; died, 1806.
- Fox, George.** English religionist. Founder of the Society of Friends. Born, 1624; died, 1690.
- Franklin, Benjamin.** American statesman and philosopher. Born in Boston; learned printer's trade; removed to Pennsylvania; published *Poor Richard's Almanac*; discovered identity of lightning and electric fluid, 1752; deputy postmaster-general of the colony; agent of the Penns in England; delegate to Continental Congress;

- Minister to France, 1776-85; President of Pennsylvania, 1785-87; member Constitutional Convention of 1787. Born, 1706; died, 1790.
- Franklin, Sir John.** English Arctic explorer. Lost in Arctic regions. Born, 1786; died, 1847.
- Frederick II.** ("The Great"). King of Prussia. Came to the throne in 1740, and invaded Silesia, which Maria Theresa ceded to him in 1742. Russia, France, and Austria began Seven Years' War against him and England (1756). He won a great victory at Prague (1757), but was defeated by Daun soon afterward; the same year defeated the French at Rossbach, and the Austrians at Leuthen. Peace was made in 1763. At the partition of Poland (1772) he got Prussian Poland. Born, 1712; died, 1786.
- Freeman, Edward Augustus.** English historian. Professor of Modern History at Oxford. *The Norman Conquest*, etc. Born, 1823; died, 1892.
- Fremont, John Charles.** American explorer, politician, and general. Republican candidate for President in 1856. Born, 1813; died, 1890.
- Fröbel, Frederick.** German educator. Introducer of the "Kindergarten" system. Born, 1782; died, 1852.
- Froissart, Jean.** French chronicler. *Les Chroniques*. Born, 1337; died, 1410.
- Froude, James A.** English historian. *History of Henry III.*, *Short Studies on Great Subjects*. Born, 1818; died, 1894.
- Fry, Elizabeth.** English philanthropist. Devoted to prison reform. Born, 1780; died, 1845.
- Fulton, Robert.** American inventor of the steamboat. Built (1807) the steamer *Clermont*, which made regular trips between New York and Albany. Born, 1765; died, 1815.
- Funston, Frederick.** American soldier. Served in the Cuban rebellion and in the Philippines. Famous for his daring; captured Aguinaldo in 1901; rewarded with rank of brigadier-general. Born, 1865.
- Gage, Lyman W.** American financier. Secretary of Treasury under President McKinley. Born, 1836.
- Galilei, Galileo.** Italian astronomer. Professor of mathematics at Padua and Pisa. Discovered law by which the velocity of falling bodies is accelerated. Constructed a telescope in 1619. Published *Dialogues on the Ptolemaic and Copernican Systems*. Born, 1564; died, 1642.
- Gall, Franz Joseph.** German physician. Founder of the system of phrenology, and with Dr. Spurzheim, his pupil, lectured on the subject throughout Europe. Born, 1758; died, 1828.
- Galvani, Louis.** Italian physicist. Discoverer of galvanism. Born, 1737; died, 1798.
- Gambetta, Leon.** French radical orator and statesman. President of the Chamber of Deputies. Born, 1838; died, 1882.
- Garfield, James A.** American President. Born in Ohio; brigadier-general, 1862; major-general for services at Chickamauga; M. C., 1862-1881; elected to Senate, 1880; elected President, 1881; shot by Charles J. Guiteau, July 2, 1881; died September 19. Born, 1831; died, 1881.
- Garland, Augustus H.** American statesman. Member Confederate Congress, 1861-65; United States senator; Governor of Arkansas, 1874; Attorney-General of the U. S. under Cleveland, 1885. Born, 1832.
- Garibaldi, Giuseppe.** Italian patriot and general. Liberator of Italy. Born, 1807; died, 1882.
- Garrick, David.** English actor. Made his debut as *Richard III.* in 1741. Among his great parts were *Lear*, *Macbeth*, *Romeo*, *Hamlet*, *Abel Drugger*; buried in Westminster Abbey. Born, 1716; died, 1779.
- Garrison, William Lloyd.** American journalist and Abolitionist. Born at Newburyport, Mass.; at Boston, in 1831, he founded his celebrated *Liberator*. Born, 1804; died, 1879.
- Gounod, Charles Francois.** French composer. Of his operas *Faust* is the best known. Born, 1818; died, 1893.
- Genghis, Khan.** Great Mongolian warrior and conqueror. Subjugated China and Persia. Born, 1163; died, 1227.
- George III.** King of England. Lost American colonies; insane latter part of his life. Born, 1738; died, 1820.
- George, Henry.** American economist. Published *Progress and Poverty* in 1879. Advocated single tax on land. Twice candidate for Mayor of New York; died in 1897 before the election. Born, 1839; died, 1897.
- Gibbon, Edward.** English historian. *Decline and Fall of the Roman Empire*. Born, 1737; died, 1794.
- Gladstone, William Ewart.** Statesman, orator, and scholar. Born at Liverpool, son of a Liverpool merchant; educated at Eton and Oxford; entered Parliament in 1832; in 1859, under Lord Palmerston, became Chancellor of the Exchequer; in 1865, he became leader of the Commons under Lord John Russell; became Premier for the first time in 1869, holding office till 1875; in 1880, became Premier for the second time; a third time in 1886, and a fourth time in 1892; failed from desertion in the Liberal ranks to carry his measure of Home Rule for Ireland; retired from office into private life in 1895; author of several works. Born, 1809; died, 1898.
- Godfrey of Bouillon.** King of Jerusalem. Hero of the first Crusade. Born, 1058; died, 1100.
- Goethe, John Wolfgang von.** German poet, dramatist, critic, novelist, man of science, statesman. *Faust*, *Iphigenia in Tauris*, *Wilhelm Meister*, *Egmont*, *Sorrows of Werther*, and many noble lyrical poems. In almost every department of literature, first among the Germans. Born, 1749; died, 1832.
- Goldsmith, Oliver.** Irish poet, novelist, and historian. *Vicar of Wakefield*, *The Traveller*, *The Deserted Village*. Born, 1728; died, 1774.
- Goodrich, Samuel G.**, "Peter Parley." American writer. *Peter Parley's Own Story*. Born, 1793; died, 1860.
- Gordon, Charles George.** English soldier and administrator. Overthrew the Taiping rebellion in China; entered the service of Egypt and became Governor of the Soudan; slain by the

- troops of the Mahdi in Khartoum. Born, 1833 ; died, 1885.
- Gough**, John B. American temperance orator. Born, 1817 ; died, 1886.
- Gracchus**, Tiberius. Roman tribune and demagogue. Passed agrarian law ; murdered. Born, B. C. 163 ; died, 133.
- Grant**, Ulysses S. American general and President. Born in Ohio ; graduated at West Point, 1839 ; served in Mexican War ; brigadier-general 1861 ; took Fort Donelson, 1862 ; Vicksburg, 1863 ; lieutenant-general, 1864 ; President, 1869-77. Born, 1822 ; died, 1885.
- Gray**, Thomas. English poet. Professor of modern history at Cambridge. *Pindaric Odes ; Elegy Written in a Country Churchyard*. Born, 1716 ; died, 1771.
- Greeley**, Horace. American journalist and politician. Founded the *New York Tribune* in 1841. Till his death he advocated temperance, anti-slavery, socialistic, and protectionist principles ; in 1872 he unsuccessfully opposed Grant for the Presidency. His works include *The American Conflict, Recollections, Essays*, etc. Born, 1811 ; died, 1872.
- Gregory I.**, "The Great." Pope. Converter of Britain. Born, 545 ; died, 604.
- Gregory VII.** (Hildebrand). Greatest of the Popes. Elected Pope in 1073 ; the Emperor, Henry IV., of Germany, deposed him, and was excommunicated. After a humiliating penance at Canossa, Henry was pardoned, but the reconciliation was only temporary. Born, 1015 ; died, 1085.
- Grey**, Lady Jane. English lady. Distinguished for rare talents. Edward VI. made her his successor as sovereign, and because of her acceptance she was imprisoned in the Tower and afterwards executed. Born, 1537 ; died, 1554.
- Grote**, George. English historian. *History of Greece*. Born, 1794 ; died, 1871.
- Guizot**, Francois P. G. French statesman and historian. Minister of Foreign Affairs. *History of France*. Born, 1787 ; died, 1874.
- Guillotine**. Joseph Ignace. A French physician after whom the Guillotine was named ; he having recommended it as a more humane method of capital punishment. Born, 1738 ; died, 1814.
- Gustavus II.** (Adolphus). King of Sweden. General. Began to reign in his seventeenth year ; soon afterward defeated the Czar and the King of Poland ; invited to become the head of the Protestant party in Germany, he entered Pomerania with 8,000 men, and took town after town ; defeated (1631) Marshal Tilly at Leipzig, and the next year on the banks of the Lech, where Tilly was slain. The Emperor now called in the great Wallenstein to oppose Gustavus ; the two generals met at Lutzen ; Gustavus was mortally wounded, but the imperial army under Wallenstein was repulsed. Born, 1594 ; died, 1632.
- Gutenberg**, Johannes or Henne, also called Gensfleisch. Claimed by the Germans to have been the inventor of the art of printing with movable types ; he set up his first printing-press at Mainz about 1450. Born, 1400 ; died, 1468.
- Hæckel**, Ernst Heinrich. German naturalist and evolutionist. Made valuable researches on the lower animals ; wrote popular works on science. Born, 1834.
- Hahnemann**, Samuel C. F. German founder of homœopathy. Proposed homœopathy, 1796 ; published *Organum of Rational Medicine*, 1810. Born, 1755 ; died, 1843.
- Hale**, Edward Everett. American author and Unitarian minister. *The Man Without a Country*, etc. Born, 1822.
- Halleck**, Fitz-Greene. American poet. *Marco Bozzaris*. Born, 1790 ; died, 1867.
- Hamilton**, Alexander. American statesman and financier. Born in Island of Nevis, West Indies. Aide-de-camp and secretary to Washington in Revolutionary War ; leading member of the Convention of 1787 ; principal author of the *Federalist* ; Secretary of the Treasury, 1789-95 ; killed in a duel by Aaron Burr. Born, 1757 ; died, 1804.
- Hamilton**, Sir William. Scotch metaphysician. Born, 1788 ; died, 1856.
- Hampton**, Wade. American general and Senator. Governor South Carolina in 1876 ; U. S. Senator, 1878. Born, 1818.
- Hancock**, John. American Revolutionary statesman ; President of the Continental Congress. Born, 1737 ; died, 1793.
- Hancock**, Winfield S. American general. Commanded at Gettysburg ; Democratic candidate for President in 1880. Born, 1824 ; died, 1886.
- Handel**, George F. German composer. Composed sonatas at ten. His oratorio of *Saul* was produced, 1740 ; his masterpiece, the *Messiah*, 1741. Among his other works are *Moses in Egypt*, *Samson*, and *Jephthah*. Born, 1684 ; died, 1739.
- Hannibal**. Carthaginian general against Rome. Son of Hamilcar, who swore him to eternal enmity with the Romans ; captured Saguntum, 219 B. C. ; crossed the Alps, 218 ; destroyed Roman army at Cannæ ; defeated by Scipio at Zama, 202 ; finally poisoned himself to escape falling into the hands of the Romans. Born B. C. 247 ; died, 183.
- Harris**, Joel Chandler. An American writer ; born in Georgia. Author of *Uncle Remus*. and other folklore stories. Born, 1848.
- Harrison**, Benjamin. Twenty-third President of the United States. Was born at North Bend, Ohio ; graduated from Miami University in 1852 ; began the practice of law in Indianapolis. Served in the Union army during the Civil War ; entered United States Senate in 1881 ; served one term as President of the United States, 1889-1893 ; defeated for second term. He was the grandson of William Henry Harrison, ninth President of the United States. Born, 1833 ; died, 1901.
- Harrison**, William Henry. American President. General ; Governor of Indiana, 1801-13, defeated Indians at Tippecanoe ; elected to Congress, 1817 ; to the Senate, 1824 ; Minister to Columbia, 1828 ; Whig candidate for President, 1836 ; elected President, 1840. Born, 1773 ; died, 1841.
- Harte**, Francis Bret. American novelist and poet. *The Heathen Chinee ; Gabriel Conroy ; Luck of Roaring Camp*. Born, 1839.

- Harvard, John.** Colonial divine. Benefactor of Harvard College, which was given his name. Born, 1608; died, 1688.
- Harvey, William.** English physician. Discoverer of the circulation of the blood. Born, 1578; died, 1657.
- Hastings, Warren.** British statesman and general; President of the Council of Bengal; conqueror of Hyder Aly; impeached for cruelty, but acquitted. Born, 1733; died, 1818.
- Hawthorne, Nathaniel.** American romance writer. *Marble Faun; The Scarlet Letter; The House of Seven Gables; The Blithedale Romance; Mosses from an Old Manse.* Born, 1804; died, 1864.
- Haydn, Francis Joseph.** German composer. Between the ages of nineteen and twenty-six, composed many sonatas, concertos, and symphonies; produced 1798, his masterpiece, *The Creation*. Born, 1732; died, 1809.
- Hayes, Rutherford B.** American President. Born in Ohio; admitted to bar, 1845; brigadier-general in Civil War; entered Congress at its close; re-elected, 1866; Governor of Ohio, 1868-76; President United States, 1877-81. Born, 1822; died, 1893.
- Hayne, Robert T.** American lawyer and Senator. Governor of South Carolina; opponent of Webster in discussing the Constitution and State rights. Born, 1791; died, 1839.
- Hegel, George W. F.** German philosopher. Professor of philosophy at Heidelberg and Berlin. He developed his system of philosophy in the *Encyclopædia of Philosophical Science*. Born, 1770; died, 1831.
- Heine, Heinrich.** German lyric poet and satirist. *Reisebilde; Lieder.* Born, 1799; died, 1856.
- Helmholtz, Hermann von.** German physicist. Famous for his researches in physiology, surgery, light, sound, etc. Born, 1821; died, 1894.
- Henry IV.** "The Great." (Henry of Navarre.) King of France. Won battle of Ivry; issued Edict of Nantes. Born, 1553; died, 1610.
- Henry V.** King of England. Conqueror at Agincourt. Born, 1388; died, 1422.
- Henry VIII.** King of England. "Defender of the Faith." Suppressed the monasteries; founded the Church of England. Born, 1491; died, 1547.
- Henry, Patrick.** American orator and revolutionary patriot. "Give me Liberty, or give me Death." Born, 1736; died, 1799.
- Herodotus.** Greek historian. *History.* Born, B. C. 484; died, 408.
- Herschel, Sir William.** English astronomer. Discoverer of Uranus. Born, 1738; died, 1822.
- Herschel, Sir John F. W.** English astronomer. *Preliminary Discourse on the Study of Natural Philosophy.* Born 1792; died, 1871.
- Higginson, Thomas Wentworth.** An American author and abolitionist. During the Civil War he commanded the first regiment of freed slaves; subsequently he resumed literary work. *History of the United States; Army Life in a Black Regiment,* etc. Born, 1823.
- Hirsch, Baron Maurice de.** Jewish financier and philanthropist. Born, 1830; died, 1896.
- Hobart, Garrett A.** Vice President U. S. with McKinley, 1896. Born, 1844; died, 1899.
- Hogarth, William.** English painter. *The Rake's Progress.* Born, 1697; died, 1764.
- Holmes, Oliver Wendell.** American poet, physician, and novelist. *Elsie Venner; The Autocrat of the Breakfast Table; The Guardian Angel; Poems.* Born, 1809; died, 1897.
- Homer.** Greek epic poet. *Iliad* and *Odyssey*. The times of his birth and death are uncertain, and his existence is doubted by some, who maintain that the *Iliad* and *Odyssey* are collections of songs by different authors. Born, B. C. 10th century.
- Hood, Thomas.** English poet and humorist. *Song of the Shirt, Whims and Oddities, Eugene Aram's Dream.* Born, 1789; died, 1845.
- Hooker, Joseph.** American general. Commander of the Army of the Potomac, 1863; defeated at Chancellorsville. Born, 1815; died, 1879.
- Horace (Q. Horatius Flaccus).** Latin poet and satirist. *Odes, Epistles, Satires.* Born, B. C. 65; died, 8.
- Houston, Samuel.** American general and statesman. Commander-in-chief of the Texan army; captured Santa Anna; Governor of Texas. Born, 1793; died, 1863.
- Howard, John.** English philanthropist and prison reformer. *The State of the Prisons in England.* Born, 1726; died, 1790.
- Howe, Elias.** American inventor. Invented the sewing machine. Born, 1819; died, 1867.
- Howe, Julia Ward.** American author and editor. Advocate of Woman's Suffrage. Made famous by her *Battle Hymn of the Republic*. Born, 1819.
- Howells, William Dean.** American novelist. *A Chance Acquaintance, A Foregone Conclusion, A Modern Instance, An Indian Summer,* are among his more popular works. Born, 1837.
- Hugo, Victor.** French poet, dramatist, and novelist. *Les Misérables; Notre Dame.* Born, 1802; died, 1885.
- Humboldt, F. H. Alexander von.** German naturalist. *Cosmos, an Essay of a Physical Description of the Universe,* etc. Born, 1769; died, 1859.
- Humbert I.** King of Italy. Succeeded to the throne in 1878; assassinated by an anarchist in 1900. Born, 1844; died, 1900.
- Hume, David.** Scottish philosopher and historian. *History of England, Enquiry into the Principles of Human Nature.* Born, 1711; died, 1776.
- Huss, John.** Bohemian reformer. *On the Church.* Was burned at the stake. Born, 1376; died, 1415.
- Ibsen, Henrik.** Norwegian dramatist. Famous for his plays on sociological subjects. *A Doll's House, The Master Builder,* etc. Born, 1828.
- Ingelow, Jean.** English poet and novelist. *Tales of Orris, A Story of Doom and other Poems.* Born, 1830; died, 1897.
- Innocent III.** One of the greatest of the Popes. Elected Pope in 1198; put France under the ban, 1199, because Philip Augustus repudiated his queen; Innocent compelled him to take her

- back. He organized the fourth Crusade, which resulted in the capture of Constantinople; in 1214 he crushed the Albigensians. Born, 1161; died, 1216.
- Irving**, Sir Henry (John Henry Brodribb). English actor in Shakesporean and modern roles; knighted in 1895. Born, 1838.
- Irving**, Washington. American author. Minister to Spain, 1842. *History of New York, The Conquest of Granada, Life of Washington, Columbus, The Sketch Book*. Born, 1783; died, 1859.
- Isabella**. "The Catholic" Queen of Castile. Patroness of Christopher Columbus. Born, 1451; died, 1504.
- Ito**, Hirobumi, Marquis. Japanese statesman. Premier of Japan; Admiral of Japanese fleet and gained great victory over China, Sept, 1895, off the Yalu River; Prime Minister again, 1900; resigned, 1901. Born, 1840.
- Jackson**, Andrew. American President and general. Born in North Carolina; began to practice law at Nashville, Tenn., 1788; M. C., 1796; Senator, 1797; Judge Tennessee Supreme Court, 1798-1804; defeated Creek Indians, 1814; won battle of New Orleans, 1815; in Seminole War, 1817-18; Senator, 1823; President, 1829-37. Born, 1767; died, 1845.
- Jackson**, Thomas J. ("Stonewall.") American Confederate general. Captured Harper's Ferry taking 11,000 prisoners; defeated Banks; accidentally killed by his own soldiers. Born, 1826; died, 1863.
- James**, Henry. American novelist. *The American, Daisy Miller, Portrait of a Lady*, etc. Born, 1843.
- James I.** of England and VI. of Scotland. Son of Mary Queen of Scots. Succeeded Elizabeth to the throne of England 1603. Translation of Bible made under his direction, and known as King James' Version. Born, 1566; died, 1625.
- Jay**, John. American jurist, diplomatist, and statesman. Negotiated treaty with England. Born, 1754; died, 1829.
- Jefferson**, Joseph. American actor. Great as *Rip Van Winkle*. Born, 1829.
- Jefferson**, Thomas. American statesman and President. Born in Virginia, studied law; member Virginia House of Burgesses; in Continental Congress, 1775; drew up Declaration of Independence, 1776; Governor of Virginia, 1779-81; Resident Minister at Paris, 1785-89; Secretary of State, 1789-93; Vice-President, 1797-1801; President, 1801-9. Born, 1743; died, 1826.
- Jeffrey**, Francis, Lord. Scotch judge and critic. Editor of the *Edinburgh Review*. Born, 1773; died, 1850.
- Jeanne D'Arc** (The Maid of Orleans). A peasant girl in Lorraine; believing herself inspired by Heaven to raise the siege of Orleans and crown Charles at Rheims, she set out to the king in 1429, was given a command, raised the siege of Orleans in one week, won the battles of Jargeau and Patay, and Charles was crowned at Rheims. Taken in a skirmish by the Burgundians, she was delivered to the English and burned as a sorceress. Born, 1411; died, 1431.
- John**. King of England. Granter of Magna Charta. Born, 1166; died, 1216.
- John III.** (John Sobieski.) King of Poland. Expelled the Turks from Austria and Poland. Born, 1629; died, 1696.
- Johnson**, Andrew. American President. In Congress, 1843-53; Governor of Tennessee, 1853-7; U. S. Senator, 1857; Military Governor of Tennessee, 1862; elected Vice-President, 1864; President on death of Lincoln, April 15, 1865; impeached, but acquitted, 1868; subsequently re-elected to the Senate. Born, 1808; died, 1875.
- Johnson**, Samuel. English poet, critic, and scholar. Born in Lichfield; educated at Oxford; published *London, Life of Richard Savage, Vanity of Human Wishes, Dictionary, Rasselas, Lives of the Poets*. Born, 1709; died, 1784.
- Johnston**, Albert Sydney. American Confederate general. Attacked Grant at Shiloh, and was killed. Born, 1803; died, 1862.
- Johnston**, Joseph E. American general. Served with distinction in Mexico. In 1861, joined Confederate army, in which he distinguished himself. Born, 1807; died, 1891.
- Jones**, John Paul. American Revolutionary naval officer. Naval victories over British. Born, 1747; died, 1792.
- Jonson**, Ben. English poet and dramatist, bricklayer and soldier. *Every Man in his Humor, Volpone, The Alchemist, The Silent Woman, Sejanus; Masques*. Born, 1574; died, 1637.
- Josephine**. Widow of Alexander de Beauharnais. Wife of Napoleon I.; Empress of France; divorced. Born, 1763; died, 1814.
- Josephus**, Flavius. Jewish historian. *History of the Jews*. Born, 35; died, 100.
- Joubert**, Petrus Jacobus. A Boer soldier. Defeated the English in 1881 and Dr. Jameson in 1896; prominent in Boer-English war. Born, 1831; died, 1900.
- Julian**. "The Apostate." Roman emperor. Restored Pagan worship. Born, 331; died, 363.
- Juvenal** (Decimus Junius Juvenalis). Latin satirist. *Satires*. Born, 40; died, 125.
- Kane**, Elisha K. American Arctic explorer. *Arctic Explorations*. Born, 1820; died, 1857.
- Kant**, Immanuel. German philosopher. *Critique of Pure Reason*. In his *Universal Natural History and Theory of the Universe* he anticipated the discovery of Uranus. Another of his important works is the *Critique of Practical Reason*. It was his aim to determine the laws and limits of human reason and of the human intellect in relation to the objects of human knowledge. Born, 1724; died, 1804.
- Kean**, Edward. English actor. Among his greatest parts were *Shylock, Richard III., Othello, Iago, King Lear*. Born, 1787; died, 1833.
- Keats**, John. English poet. Born in London; apprenticed to a surgeon; died at Rome. *Endymion, Hyperion, The Eve of St. Agnes*. Born, 1795; died, 1821.
- Kelvin**, William Thomson, Lord. Scotch physicist. Famous for his discoveries in electric and dynamic

- science, and researches on wave-motion and the ether. Created Lord Kelvin in 1892. Born, 1824.
- Kempis**, Thomas à. German ascetic writer. *Imitatio Christi*. Born, 1380; died, 1471.
- Kepler**, John. German astronomer. Discovered the mathematical laws of the solar system. Born, 1571; died, 1630.
- Key**, Francis Scott. American song-writer. *Star-Spangled Banner*. Born, 1799; died, 1843.
- Kingsley**, Charles. English divine and novelist. *Hypatia*, *Westward Ho*, *Hereward*. Born, 1819; died, 1875.
- Kingsley**, Henry. English novelist. *Ravenshoe*. Born, 1830; died, 1876.
- Kipling**, Rudyard. Story-teller and poet. Born in Bombay, and educated in England. His *Soldiers Three*, and other stories, gained for him an immediate and wide reputation. As a poet, his most successful effort is his *Barrack-Room Ballads*. Born, 1865.
- Kitchener**, Lord Horatio Herbert. English soldier. Hero of Soudan Campaign in 1898. Boer War 1899 and 1900. Born, 1850.
- Knox**, John. Scotch Reformer. Fierce anti-Catholic. *The First Blast of the Trumpet*. Born, 1505; died, 1572.
- Koch**, Robert. German bacteriologist. Born at Klausthal, in Hanover; famous for his researches in bacteriology; discovered sundry bacilli, among others the cholera bacillus and the phthisis bacillus, and a specific against it. Born, 1843.
- Kosciusko**, Thaddeus. Polish patriot and general. Commander of the Polish insurgent army; defeated at Warsaw, which he bravely defended. Born, 1745; died, 1817.
- Kossuth**, Louis. Hungarian orator and patriot. Leading spirit in the insurrection of 1848-49; effected many important reforms. Born, 1802; died, 1894.
- Kropotkin**, Prince Peter. Russian Nihilist. Arrested in Russia and escaped; imprisoned in France. Wrote *Paroles d'un Revolte*, *In Russian and French Prisons*. Born, 1842.
- Kruger**, Stephanus Johannes Paul. President of the South African Republic after 1883. Declared war against England in 1899. Went for aid to Europe in 1900. Born, 1825.
- La Fayette**, Marie J. P. R. P. Gilbert Motier, Marquis de. Joined American army as major-general, 1777; commanded advance guard of Washington at Yorktown; commander of French national guard, 1789; revisited America, 1824; took part in revolution of 1830. Born, 1757; died, 1834.
- Lamarck**, Jean Baptiste de. French naturalist. Famous for his theory of animal evolution. *Philosophie Zoologique*. Born, 1744; died, 1829.
- Lamb**, Charles. English author and humorist. *Essays of Elia*; *Essays on Tragedies of Shakespeare*, etc. Born, 1775; died, 1834.
- Landseer**, Sir Edwin. English painter. *The Old Shepherd's Chief Mourner*. Born, 1802; died, 1873.
- Laplace**, Pierre Simon, Marquis of. Great French mathematician and astronomer. Discovered the theory of Jupiter's satellites and the causes of the acceleration of the moon's mean motion, and of the inequality of Jupiter and Saturn. His *Exposition of the System of the universe* is a popular form of his great work *La Mecanique Celeste*. He was one of the greatest mathematicians and astronomers. Born, 1749; died, 1827.
- Latimer**, Hugh, Bishop of Worcester. English reformer. Burned. Born, 1480; died, 1555.
- Laurier**, Sir Wilfred. Canadian Premier after 1896. The First French Canadian to attain the honor. Elected in 1871 as a Liberal to the Quebec Provincial Assembly; in 1874 to the Federal Assembly. He stood first among the Colonial representatives at Queen Victoria's Diamond Jubilee in 1897. Born, 1841.
- Law**, John. Scotch financier in France. Promoter of the "South Sea Bubble." Born, 1671; died, 1729.
- Lawrence**, James. American naval commander. Commander of the *Chesapeake*; killed fighting the British *Shannon*. "Don't give up the ship." Born, 1781; died, 1813.
- Layard**, Sir Henry Austin. Assyrian excavator. He made wonderful discoveries at the site of Nineveh, and wrote *Nineveh and its Remains*, etc. Born, 1817; died, 1894.
- Lecky**, William Edward Hartpole. English historian. *Rationalism in Europe*, *European Morals*, *England in the 18th Century*. Born, 1838.
- Lebrun**, Charles. French painter. *The Family of Darius*. Born, 1619; died, 1690.
- Lebrun**, Charles Francois, Duke of Placentia. French politician. Third consul; Governor-General of Holland. Born, 1739; died, 1824.
- Lee**, Arthur. American statesman and diplomatist. Member of Congress; Minister to France. Born, 1740; died, 1792.
- Lee**, Fitzhugh. American general, Confederate soldier, Consul-General to Cuba. Commanded a division in Cuba during reconstruction. Born, 1835.
- Lee**, Francis Lightfoot. American Revolutionary patriot. Member Congress; signed Declaration of Independence. Born, 1734; died, 1797.
- Lee**, Henry. American Revolutionary soldier. "Light Horse Harry." Served under Greene; Governor of Virginia. Born, 1756; died, 1818.
- Lee**, Richard Henry. American Revolutionary statesman. Signed Declaration of Independence; President of Congress; U. S. Senator. Born, 1732; died, 1794.
- Lee**, Robert Edward. American Confederate general. Commander-in-chief of Confederate army. Born, 1807; died, 1876.
- Leibnitz**, Godfrey William, Baron. German mathematician and philosopher. In 1676 he discovered the infinitesimal calculus, about which he had a bitter dispute with Newton. In his treatise *Protogæa* (1693) he anticipated many of the discoveries of modern geology. In his *New Essay on the Human Understanding* he opposes Locke. Born, 1646; died, 1716.
- Leicester**, Robert Dudley, Earl of. Favorite of Queen Elizabeth; commander of the English contingent in the Netherlands. Born, 1532; died, 1588.

- Lely**, Sir Peter. German portrait painter in England. Painter to Charles II. Born, 1617; died, 1680.
- Leonidas**. King of Sparta. Leader of the Three Hundred at Thermopylæ. Born, B. C. —; died, 480.
- Leopold, I.** Surnamed *The Great*. Emperor of Germany; waged fierce wars with the Turks for a long period of years, beginning in 1664. His last great battles were in Italy, and his troops played an important part in the decisive battle of Blenheim, 1704. Born, 1640; died, 1705.
- Le Sage**, Alain Rene. French novelist. *Gil Blas*. Born, 1668; died, 1747.
- Lessing**, Gotthold Ephraim. German critic and poet. *Laocoon*; *Nathan the Wise*. Born, 1729; died, 1781.
- Lever**, Charles. Irish novelist. *Charles O'Malley*, *Harry Lorrequer*. Born, 1806; died, 1872.
- Li Hung-Chang**. Chinese statesman. He aided Gordon in suppressing the Taiping rebellion; made governor-general of Chang, 1864; of Chi-li, 1872; founded the Chinese navy; commander-in-chief in the war with Japan, 1894; made treaty of peace; visited Europe and America 1896; selected to deal with the western powers after the Boxer outbreak of 1900. Born, 1828.
- Lincoln**, Abraham. President of the United States, 1861–1865. Born in Kentucky; afterwards removed to Illinois; captain in Black Hawk War; admitted to Illinois bar, 1836; Whig M. C., 1846; unsuccessful candidate for Senator against Douglas, 1856; elected President, 1860; re-elected, 1864; assassinated by J. Wilkes Booth, April 14, 1865; died April 15. Born, 1809; died, 1865.
- Lind**, Jenny. Celebrated Swedish singer. At 16 years the favorite opera singer of her native land; toured the world with marvelous success. Born, 1821; died, 1887.
- Linnæus**, Charles von. German botanist. Studied medicine and natural history. *System of Nature*, *Genera of Plants*; *Philosophia Botanica*, *Species Plantarum*. Designated each species of plants by adding single epithet to name of genus. Born, 1707; died, 1778.
- Liszt**, Franz. Celebrated Hungarian pianist. Born, 1811; died, 1886.
- Livingstone**, David. African explorer. *Narrative of an Expedition to the Zambesi*. Born, 1817; died, 1873.
- Livy**. (Titus Livius.) Roman historian. Famous for the rare style of his *History of Rome*. Born, B. C. 59; died, A. D. 17.
- Locke**, John. English philosopher. *Human Understanding*. Born, 1632; died, 1704.
- Longfellow**, Henry Wadsworth. American poet. *Hyperion*, *Ballads and other Poems*, *The Spanish Student*, *The Belfry of Bruges*, *Evangeline*, *The Golden Legion*, *Hiawatha*, *Miles Standish*, *Tales of a Wayside Inn*. Born, 1807; died, 1882.
- Louis XIV.** King of France. Son of Louis XIII. and Anne of Austria. Fought England, Austria, Spain, and Belgium, and engaged in the war of the Spanish Succession; was a patron of literature and the arts. Born, 1638; died, 1715.
- Louis XVI.** King of France. Married Marie Antoinette, 1770; succeeded Louis XV., 1774; imprisoned by the revolutionists; guillotined. Born, 1754; died, 1793.
- Louis Philippe**. King of France. "The citizen king." Abdicated in 1848. Born, 1773; died, 1850.
- Lowell**, James Russell. American poet, critic and diplomatist. *The Bigelow Papers*, *The Vision of Sir Launfal*, *The Commemoration Ode*, *Fable for Critics*, *The Cathedral*, *Among my Books*, *My Study Windows*. Minister to Spain and England. Born, 1819; died, 1891.
- Loubet**, Emile. President of France. He studied the law; was elected deputy in 1876; Senator in 1885; became Premier in 1892; President of the Senate in 1896, and succeeded M. Faure as President of the Republic of France in 1899. Born, 1839.
- Loyola**, Ignatius. He founded the Society of Jesus, with the object of renovating the Church and converting the infidels; left a devotional work called *Spiritual Exercise*. Born, 1491; died, 1536.
- Lubbock**, Sir John. English banker and naturalist; member Parliament. *The Origin of Civilization*. Born, 1834.
- Lucian**. Greek essayist and satirist. Famous for his delightful style and fine humor. *Dialogues of the Dead*; *True Histories*. Born, 125; died, 180.
- Luther**, Martin. German reformer. Became a priest in 1507; published (1517) ninety-five propositions against indulgences; burnt the Pope's Bull at Wittenburg. Justification by faith was the central point of his theology. Born, 1483; died, 1546.
- Lycurgus**. Spartan legislator. Instituted community of property and double executive at Sparta in the 9th century. Born, B. C. 850; died, —.
- Lyell**, Sir Charles. English geologist. Founded the uniform theory of geology. *Principles of Geology*. Born, 1797; died, 1875.
- Lyttelton**, Sir Thomas. English lawyer and judge. *Tenures*. Born, 1420; died, 1481.
- Lytton**, Sir Edward G. E. Lytton Bulwer, Baron. English novelist and dramatist. *The Caxtons*; *Richelieu*. Born, 1805; died, 1873.
- Lytton**, Lord Edward Robert Bulwer. ("Owen Meredith.") English statesman and novelist. *Lucille*. Born, 1831.
- Macaulay**, Thomas Babington, Lord. English historian and essayist. *History of England*, *Essays*, *Lays of Ancient Rome*. Born, 1809; died, 1859.
- Maclaren**, Ian (*nom de plume* of Rev. John Watson). Was minister of the Free Church in Logiealmond, and in Glasgow and Liverpool. *Beside the Bonnie Briar Bush*, etc. Born, 1850.
- Macdonald**, Sir John Alexander. Regarded as Canada's greatest statesman; organizer of the first government of the Dominion and its first Prime Minister. Born, 1815; died, 1891.
- MacMaster**, John Bach. American historian. Professor American history, University of Pennsyl-

- vania. *History of the People of the United States*, etc. Born, 1852.
- McCarthy**, Justin. An Irish author and statesman. Leader of his party in House in Parliament, 1890 to 1896. *A History of Our Own Times*, *History of the Four Georges*, and a number of popular novels. Born, 1830.
- McClellan**, George B. American general. Won battle of Antietam in the Civil War. Born, 1826; died, 1885.
- McKinley**, William. American statesman; served in the Civil War; entered Congress in 1877; passed in 1890 a tariff measure named after him; was elected to the U. S. Presidency as the champion of a sound currency in opposition to Mr. Bryan in November, 1896, and again in November, 1900. Born, 1844.
- Madison**, James. American President. Member of the Virginia Legislature, of the convention of 1787, and a strenuous advocate of the Constitution; joint author with Hamilton and Jay of the *Federalist*; M. C., 1789-97; Secretary of State, 1801-9; President, 1809-17. Born, 1751; died, 1836.
- Magellan**, Ferdinand de. Portuguese navigator. Magellan's Straits is named after him. Born, 1470; died, 1521.
- Mahan**, Alfred Thayer. An American naval officer and writer. *Influence of Sea Power upon History*. Born, 1840.
- Mahomet**. Arabian prophet. Founder of Mohammedanism. When 40 years of age, receiving a pretended revelation from Allah, he devoted himself to the propagation of a new religion. His faith was rejected at Mecca, but taken up at Medina. He fled from Mecca 622 (The Hegira); was originally a monogamist, and at first asserted liberty of conscience. Born, 570; died, 632.
- Mandeville**, Sir John. English traveler in the East. Often called the first English prose writer. Born, 1300; died, 1372.
- Mann**, Horace. American educationist. Member of Congress; President of Antioch College. Anti-slavery advocate. Born, 1796; died, 1859.
- Marat**, Jean P. French Revolutionist. Assassinated. Born, 1744; died, 1793.
- Marconi**, Guglielmo. Italian electrician. Discovered a practical system of telegraphing without wires. Born, 1875.
- Maria Theresa**. Empress of Austria and Queen of Hungary. Her husband, Francis, Duke of Lorraine, was chosen Emperor in 1745, but she was the real power; took part in the Seven Years' War; abolished feudal service. Born, 1717; died, 1780.
- Marion**, Francis. American general and patriot. Noted for his guerilla warfare against the British during the Revolutionary war. Born, 1732; died, 1795.
- Marlborough**, John Churchill, Duke of. English commander. Made Earl of Marlborough, 1689; commanded English forces in Low Countries, 1689; deposed for his Jacobite intrigue, 1692; restored, 1696; commander of allied armies in Holland, 1702; won battle of Blenheim, 1704; Ramillies, 1706; Malplaquet, 1709. His wife was the confidante of Queen Anne. In disgrace from 1711 till accession of George I. Born, 1650; died, 1722.
- Marlowe**, Christopher. English poet and dramatist. Born, 1564; died, 1593.
- Marshal**, John. Chief Justice of the United States. Captain in the Revolutionary War, at the close of which he began to practice law in Virginia; a member of the Virginia Convention (1788); in 1797, with Pinckney and Gerry, he went on a diplomatic mission to France; elected to Congress in 1799; appointed Secretary of State 1800, and resigned that office to become Chief Justice. Was the greatest judge that ever held the latter office. Born, 1755; died, 1835.
- Maartens**, Maarten. Dutch novelist. Wrote in English *God's Fool*, *My Lady Nobody*, etc. Born, 1858.
- Mary**. Queen of England. Married Philip II. of Spain. Persecutor of the Protestants. Born, 1516; died, 1558.
- Mary Stuart**. Queen of Scots. Daughter of James V. Was invited to the throne of Scotland (1560.) Compelled to take refuge in England, she was finally beheaded by Elizabeth on a charge of conspiracy. Born, 1542; died, 1587.
- Mathew**, Theobald. "Father Mathew." Irish temperance reformer. Born, 1790; died, 1856.
- Mazzini**, Guiseppe. Italian patriot. Co-operated with Garibaldi; founder of Young Italy. Born, 1808; died, 1872.
- Meade**, George G. American general. Won battle of Gettysburg. Born, 1815; died, 1872.
- Medici**, Catherine de'. Queen of Henry II. of France. Instigated massacre of St. Bartholomew. Born, 1519; died, 1589.
- Medici**, Lorenzo de'. Grand Duke of Florence. "The Magnificent." Patron of art and literature; adorned Florence. Born, 1448; died, 1492.
- Meissonier**, Jean Louis Earnest. French painter. Distinguished for his highly finished small works. *The Chess Players*; *Freedland or 1807*. Born, 1813; died, 1891.
- Mendelssohn-Bartholdy**, Felix. German composer. Among his most famous works are his *Songs Without Words*. Born, 1809; died, 1847.
- Mesmer**, Frederick B. Suabian physician. Founder of Mesmerism. Born, 1731; died, 1815.
- Meyerbeer**, James. German composer. *Romilda e Costanza*, 1818; *Semiramide Riconosciuta*, 1819; *Crociato in Egipto*, 1824; *Robert le Diable*, 1831; *Huguenots*, 1836; *L'Etoile du Nord*, 1854. Born, 1791; died, 1864.
- Mezzofanti**, Guiseppe G., Cardinal. Italian linguist. Born, 1774; died, 1849.
- Michael Angelo** (Buonarotti). Italian painter, sculptor, and architect. Painted the fresco of the *Last Judgment*, and prophets, sibyls, etc., at the Sistine Chapel. Among his great sculptures are the gigantic marble *David* and *Moses*; was appointed architect of St. Peter's, and formed a model for the dome; wrote sonnets and poems. Born, 1474; died, 1564.
- Miles**, Nelson A. American General-in-chief of the United States army in Spanish War. Received surrender of Porto Rico. Won fame in Civil War. Captured Jefferson Davis. Born, 1839.

- Mill, John Stuart.** English political economist and philosopher. *Logic, Political Economy, Examination of Sir W. Hamilton's Philosophy*. Born, 1806; died, 1873.
- Millais, Sir John E.** English painter. *Return of the Dove to the Ark*. Born, 1829; died, 1896.
- Miller, Hugh.** Scotch geologist. *Old Red Sandstone*. Born, 1802; died, 1856.
- Miltiades.** Athenian general. Commander at Marathon. Flourished 500 B. C.
- Milton, John.** English poet. *Paradise Lost*. Wrote many prose, political and controversial works. His sonnets are among the best in the language. His other works are *Comus, L'Allegro, Il Penseroso, Samson Agonistes, Paradise Regained, Lycidas*. Born, 1608; died, 1674.
- Mirabeau, Gabriel H. de Riquetti, Count of.** French orator and revolutionist. Entered army, 1767; imprisoned by his father at various times for intrigues and debts; president of National Convention, 1791. Born, 1749; died, 1791.
- Mitchell, Donald G.** ("Ik. Marvel.") American author. *My Farm at Edgewood; Reveries of a Bachelor*. Born, 1822.
- Mithridates.** "The Great." King of Pontus. With Tigranes of Armenia he fought the Romans for many years. Born, B. C. 130; died, 63.
- Moltke, Hillmuth, Count von.** German general. Conqueror in the Franco-Prussian war. Born, 1800; died, 1891.
- Monroe, James.** American President. Captain in Revolutionary War; studied law with Jefferson; delegate to Congress, 1783; opponent of Constitution; Senator, 1790; Minister to France, 1794-6; Governor of Virginia, 1799-1802; Envoy-Extraordinary to France, 1802; Minister to England, 1803; Governor of Virginia, 1811; Secretary of State, 1811-17; President, 1817-25. Born, 1758; died, 1831.
- Montcalm, Louis J. de St. V6ran, Marquis of.** French commander in Canada. Killed on Abraham's Heights, in the battle with Wolfe. Born, 1712; died, 1759.
- Montesquieu, Charles de Secondat, Baron de.** French author. *Spirit of the Laws*. Born, 1689; died, 1755.
- Montezuma II.** Last Emperor of Mexico. Mortally wounded while attempting to quell insurrection of his subjects against Cortez. Born, 1470; died, 1520.
- Moody, Dwight Lyman.** Evangelist. Associated with Mr. Sankey; visited Great Britain in 1873 and 1883. Born, 1837; died, 1900.
- Moore, Thomas.** Irish poet. *Lalla Rookh, Irish Melodies, The Epicurean, Life of Sheridan, Life of Lord Byron*. Born 1779; died, 1852.
- More, Sir Thomas.** English statesman and author. Lord Chancellor; became favorite of Henry VIII.; published *Utopia*, 1516; speaker of House of Commons, 1523; Lord Chancellor, 1532; refused to acknowledge the validity of Henry's marriage to Anne Boleyn. Born, 1480; died, 1530.
- Morris, Gouverneur.** American Revolutionary statesman and orator. Minister to France; United States Senator; promoter of Erie Canal. Born, 1754; died, 1816.
- Morris, Robert.** American financier and statesman. Aided the Government with funds in the Revolution; Superintendent of Finances, 1781-4; imprisoned for debt. Born, 1734; died, 1800.
- Morris, William.** English poet and artistic designer of household decorations. *The Earthly Paradise, News from Nowhere*, etc. Born, 1834; died, 1896.
- Morse, Samuel Finley Breese.** American inventor of telegraph. Constructed small recording electric telegraph in 1835; constructed telegraph line from Washington to Baltimore, and brought telegraph into successful operation in 1846. Born, 1794; died, 1872.
- Motley, John Lothrop.** American historian and diplomatist. Minister to England and Austria. *The Rise of the Dutch Republic*. Born, 1814; Died, 1877.
- Mozart, Johann.** German composer. *The Marriage of Figaro, Don Giovanni, The Magic Flute*. His latest work, the *Requiem*, is his most sublime. Born, 1756; died, 1791.
- Muller, F. Max.** German philologist in England. *Chips from a German Workshop*. Born, 1833; died, 1900.
- Murat, Joachim.** French Marshal and King of Naples. Dashing cavalry leader. Born, 1770; died, 1815.
- Murillo, Bartholomew Stephen.** Spanish painter. His virgin saints and his beggar boys are famous. Among his great works are *St. Elizabeth of Hungary, The Prodigal Son, The Young Beggar, Moses Striking the Rock, St. Anthony of Padua*, and the *Marriage of St. Catherine*. Born, 1618; died, 1682.
- Nansen, Fridtjof.** Norwegian Arctic discoverer. Made his first journey across Greenland in 1888; set out in 1893 in the *Fram*, to drift to the pole; reached in 1895 86° 14' north latitude, the highest then attained. Wintered in Franz Joseph Land; rescued in 1896. *The First Crossing of Greenland, Farthest North*. Born, 1861.
- Nelson, Horatio, Viscount.** English naval commander. Went to sea at thirteen; post captain, 1779; rear admiral, 1797; won battle of the Nile, 1798; second in command at Copenhagen, 1801, (but really won the fight); in 1805, with twenty-seven sail of the line and four frigates, defeated combined French and Spanish fleets at Trafalgar, where he was mortally wounded. Born, 1758; died, 1805.
- Nero.** Roman Emperor (54-68). Put his mother to death; persecuted Christians; said to have burned Rome. Born, 37; died, 68.
- Newcomb, Simon.** American astronomer. Conducted the American *Nautical Almanac*. Wrote much on astronomy. Born, 1835.
- Newman, John Henry, Cardinal.** English Catholic theologian. Born, 1801; died, 1840.
- Newton, Sir Isaac.** English mathematician and philosopher. His great work, the *Principia*, appeared in 1687. In this he shows that every particle of matter is attracted by every other particle with a force inversely proportional to the squares of the distances. Born, 1642; died, 1727.

Ney, Michael. "The Bravest of the Brave." One of Napoleon's marshals. Led Guard at Waterloo; shot by order of Louis XVII. Born, 1769; died, 1815.

Nicholas I. Czar of Russia. Warred with Turkey and Persia; put down Polish insurrection; engaged in Crimean War. Born, 1796; died, 1855.

Nicholas II. Czar of Russia. Son of Alexander III., and his successor in November, 1894. Married Princess Alice, granddaughter of Queen Victoria. Born, 1868.

Nightingale, Florence. English philanthropist. *Notes on Nursing.* Born, 1820.

Nobel, Alfred. Danish manufacturer. Discovered how to make dynamite. Left \$10,000,000, most of it to go for annual prizes for important scientific discoveries, best literature, and best work in the cause of humanity. Born, 1833; died, 1896.

Nordenskiöld, Baron Nils Adolf Erik. Swedish explorer. In 1878-79 he made the first voyage from the Atlantic to the Pacific, north of Asia. *Voyage of the Vega.* Born, 1832.

Oates, Titus. English informer; inventor of the "Popish Plot." Born, 1620; died, 1705.

O'Connell, Daniel. Irish orator and agitator; advocate of Catholic Emancipation, and the repeal of the union. Born, 1775; died, 1847.

Oersted, Hans C. Danish scientist; founder of the science of electro-magnetism. Born, 1775; died, 1851.

Oglethorpe, James. British general; colonizer of Georgia. Born, 1688; died, 1785.

Ohm, Georg Simon. German physicist. Discovered the mathematical theory of the electric current, known as Ohm's Law. Born, 1787; died, 1854.

Oliphant, Margaret. Authoress. She wrote on history, biography, and criticism; *The Makers of Florence, of Venice, of Modern Rome; Lives of Dante, Cervantes, and Edward Irving.* Born, 1828; died, 1897.

Origen. Greek Father of the Church. *Heretics.* Held universal restoration of the dead. Born, 185; died, 253.

Otis, Harrison Gray. American statesman and orator. A Federalist leader in Congress. Born, 1765; died, 1848.

Otis, James. American Revolutionary statesman and orator. Argued against writs of assistance; led popular party. Born, 1726; died, 1783.

Outram, Sir James. English general in India. Led expedition against Persia, 1836. Born, 1802; died, 1863.

Ovid, (Publius Ovidius Naso). Roman poet. *Metamorphoses.* Born, B.C. 43; died, A. D. 18.

Paderewski, Ignace Jan. Celebrated pianist. Born at Podolia, in Russian Poland; master of his art by incessant practice from early childhood; twice visited the United States; a brilliant composer as well as performer. Born, 1860.

Paganini, Niccolò. Italian violinist; celebrated for his performances on a single string. Born, 1784; died, 1840.

Paine, Robert Treat. American lawyer and states-

man. Signed Declaration of Independence. Born 1731; died, 1814.

Paine, Thomas. American (English born) deist and political writer. *The Age of Reason, Common Sense.* Born, 1737; died, 1809.

Paley, William. English divine and theologian. *Evidences.* Born, 1743; died, 1805.

Palissy, Bernard. French potter. Discovered the art of enamelling stoneware. *Treatise on the Origin of Fountains.* Born, 1510; died, 1596.

Palmerston, Henry John Temple, 3d Viscount. English statesman; Minister of Foreign Affairs; long Prime Minister. Born, 1784; died, 1865.

Park, Mungo. Scotch traveler in Africa. *Travels in the Interior of Africa.* Born, 1771; died, 1805.

Parker, Theodore. American theologian and reformer. *Transient and Permanent in Christianity.* Born, 1810; died, 1860.

Parkman, Francis. American historian. *Conspiracy of Pontiac, A Half Century of Conflict,* etc. Born, 1823; died, 1893.

Parnell, Charles Stewart. Irish politician and agitator; M. P.; head of the Land League movement. Born, 1847; died, 1891.

Parr, Catherine. Last Queen of Henry VIII. of England, whom she succeeded in surviving. Born, 1509; died, 1548.

Parton, James. Noted American biographer. Married sister of N. P. Willis, who, as "Fannie Fern," wrote many children's books. Born, 1822; died, 1891.

Pascal, Blaise. Illustrious French thinker and writer. Was distinguished at once as a mathematician, a physicist, and a philosopher. Born, 1623; died, 1662.

Pasteur, Louis. French bacteriologist. He discovered the origin of fermentation, the silk-worm disease, splenic fever, etc., to be due to micro-organisms, and founded the germ theory of disease. Born, 1822; died, 1895.

Patrick, Saint. Apostle of Ireland. Born in Scotland. One of the first to preach Christianity in Ireland. Born, 372; died, 463.

Paul, Saint, of Tarsus. Apostle of the Gentiles. Born, —; died, 65.

Payne, John Howard. American dramatist and poet. *Home, Sweet Home.* Born, 1792; died, 1852.

Peabody, George. American banker in London; philanthropist. Founder of homes for workmen in London, of museums, etc. Patron of education. Born, 1795; died, 1869.

Peary, Robert. American Arctic discoverer. He made three journeys to the far North; crossed northern Greenland in 1891 and 1894, and was in the polar regions in 1901. Born, 1856.

Peel, Sir Robert. English statesman and Prime Minister. Repealed the Corn Laws. Born, 1788; died, 1850.

Penn, William. Founder of Pennsylvania. The son of Admiral Penn, born in London; was converted to Quakerism while a student at Oxford. His father's death brought him a fortune and a claim upon the Crown, which he commuted for a grant of land in North America, where he founded

- (1682) Pennsylvania. Here he established a refuge for all persecuted religionists, and, laying out Philadelphia as the capital, governed his colony wisely and generously for two years. He returned to England, where his friendship with James II. brought many advantages to the Quakers, but laid him under harassing and undeserved prosecutions for treason in the succeeding reign. The closing years of his life were clouded by mental decay. Born, 1644; died, 1718.
- Pericles.** Athenian orator and statesman. Came forward as a leader of the democracy 470 B. C. He secured the ostracism of Cimon, and after that event, and the ostracism of Thucydides, was the first man in Athens. He greatly increased the influence of Athens, which he adorned with noble public works. Born, B. C. —; died, 429.
- Perry, Matthew C.** American commodore. Chief of expedition to Japan. Born, 1795; died, 1858.
- Perry, Oliver H.** American naval commander. Won battle of Lake Erie. Born, 1785; died, 1820.
- Pestalozzi, Giovanni H.** Swiss educator. *Leinhard und Gertrude*. Born, 1746; died, 1827.
- Peter the Hermit.** Preacher of the First Crusade. Born, 1050; died, 1115.
- Peter I.** ("The Great.") Czar of Russia. Visited Western Europe in 1697; was for a time a ship-carpenter in Holland, and spent eight months in England; on his return to Russia, he reorganized the army and navy, founded schools, and took measures to increase Russian commerce; he made an alliance with Poland and Denmark, (1701) against Charles XII., whom he defeated at Pultowa (1709); founded St. Petersburg (1703). Born, 1672; died, 1725.
- Petrarch, Francis.** (Francesco Petrarca.) Italian poet and scholar. *Sonnets*. Born, 1304; died, 1374.
- Phidias.** Greatest of Greek sculptors. His masterpieces were the colossal ivory-and-gold statues (forty feet high) of Minerva at the Parthenon, and of Zeus at Olympia in Elis; the latter being counted one of the wonders of the world. Born, B. C. 490; died, 432.
- Philip II.** King of Macedonia. Father of Alexander the Great. Assassinated. Born, B. C. 382; died, 335.
- Philip II.** ("Augustus.") King of France. Annexed Normandy, Anjou, Lorraine; won battle of Bouvines. Born, 1165; died, 1223.
- Philip IV.** ("The Fair.") King of France. Suppressed the Templars; imprisoned Pope Boniface VIII. Born, 1268; died, 1314.
- Philip II.** King of Spain. Son of Charles V. Caused revolt in Netherlands; despatched Armada against England. Born, 1527; died, 1598.
- Phillips, Wendell.** American orator, Abolitionist. *Speech in Faneuil Hall*, 1836. Born, 1811; died, 1884.
- Pierce, Franklin.** American President. Born in New Hampshire; studied law; Democratic member Congress, 1832-37; U. S. Senator, 1837-42; brigadier-general in Mexican War; President, 1853-57; opposed coercion of seceding States. Born, 1804; died, 1869.
- Pindar.** Lyric poet of Thebes. *Odes*. Born, B. C. 518; died, 442.
- Pisistratus.** Tyrant of Athens. Patron of learning. Said to have had *Iliad and Odyssey* reduced to writing for the first time. Born, B. C. 612; died, 527.
- Pitt, William.** English statesman and orator; the second son of Lord Chatham. Entered Parliament in 1781; Chancellor of the Exchequer, 1782; First Lord of the Treasury, and Prime Minister, 1783; resigned in 1801, but took office again in 1804; was the head and front of the great coalition against Bonaparte. Born, 1759; died, 1806.
- Pius IX.** (Giovanni Maria Mastai Ferretti). Pope. Dogmas of Immaculate Conception and Papal Infallibility promulgated during his incumbency; temporal power lost 1870. Born, 1792; died, 1878.
- Pizarro, Francis.** Spanish conqueror of Peru. Born, 1475; died, 1541.
- Plato.** Greek philosopher and writer. Among his works are *The Republic*, *Phædo*, *Gorgias*, *Crito*, and *Apology for Socrates*. Born, B. C. 428; died, 347.
- Pliny, The Elder.** Roman savant and writer. *Natural History*. Born, 23; died, 79.
- Pliny, The Younger.** Roman writer and statesman. *Panegyric on Trajan*. Born, 61; died, 106.
- Plutarch, Greek biographer.** *Lives*. Born, 45; died, 120.
- Poe, Edgar Allen.** American poet. *The Raven*. Born, 1811; died, 1849.
- Polk, James K.** American President. Born in North Carolina; removed to Tennessee, 1806; studied law; member of Congress, 1825; elected speaker, 1835 and 1837; governor of Tennessee, 1839-41; Democratic President, 1845-49; prosecuted Mexican War. Born, 1795; died, 1849.
- Polk, Leonidas, Bishop.** American Confederate general and Episcopal prelate. Conspicuous at Shiloh and Stone River. Born, 1806; died, 1864.
- Polo, Marco.** Venetian traveler in the East. *The Book of Marco Polo*. Born, 1256; died, 1333.
- Pompey** (Cnæus Pompeius). Roman general and statesman. Conqueror of Spain and victor over Mithridates; leader of aristocracy; rival of Cæsar; defeated at Pharsalia. Born, B. E. 106; died, 48.
- Ponce de Leon, Juan.** Spanish discoverer of Florida. Born, 1460; died, 1521.
- Pope, Alexander.** English poet. *Pastorals*, *Essay on Criticism*, *Essay on Man*, etc. Born, 1688; died, 1744.
- Porter, David.** American naval officer. Commander of the *Essex*. Born, 1780; died, 1843.
- Porter, David D.** American naval officer. Admiral; bombarded Fort Fisher. *History of the Navy in the Rebellion*. Born, 1813; died, 1887.
- Porter, Noah.** American philosophical writer. President of Yale. *Human Intellect*. Born, 1811.
- Prescott, William Hickling.** American historian. *Ferdinand and Isabella*, etc. Born, 1796; died, 1859.
- Ptolemy I.** ("Soter.") King of Egypt. Founder of the dynasty of Greek sovereigns in Egypt; patron of literature. Born, B. C. 367; died, 282.
- Ptolemy II.** ("Philadelphus"). King of Egypt.

- Founder of Alexandrian Library; Theocritus, Euclid, Aratus lived at his court. Born, B. C. 309; died, 247.
- Ptolemy**, Claudius. Greek mathematician and geographer. *Almagest*. Lived from about 100 to 160.
- Pulaski**, Count. Polish general in the American Revolution. Leader of "Pulaski's Legion;" killed at siege of Savannah. Born, 1747; died, 1779.
- Putnam**, Israel. General in the American Revolution. Conspicuous at Bunker Hill. Born, 1718; died, 1790.
- Pyrrhus**. King of Epirus. Defeated the Romans; conquered Macedonia; one of the greatest generals of antiquity. Born, B. C. 318; died, 272.
- Pythagoras**. Greek philosopher and writer. Taught doctrine of transmigration of souls. Born, B. C. 570; died, 510.
- Quincy**, Josiah. American statesman and author. Federalist member of Congress. *History of Harvard University*. Born, 1772; died, 1864.
- Quincy**, Josiah, Jr. American Revolutionary patriot and orator. *Observations on the Boston Port Bill*. Born, 1744; died, 1775.
- Rabelais**, Francois. French satirist and scholar. Joined Franciscans, but left the order. His great work is *The Pleasant Story of the Giant Gargantua and his Son Pantagruel*. Born, 1495; died, 1553.
- Racine**, Louis. French dramatist. Among his best works are the comedy *Les Pladeurs* (The Litigants), and the tragedies *Britannicus*, *Iphigenie*, *Phidre*, and *Athalie*. Born, 1639; died, 1699.
- Raleigh**, Sir Walter. English courtier, statesman, and author. *History of the World*. A favorite of Queen Elizabeth; executed by James I. Born, 1552; died, 1618.
- Randolph**, John, of Roanoke. American politician. Member of Congress; Minister to Russia; opposed Missouri Compromise; caustic wit. Born, 1773; died, 1833.
- Raphael**, (Raffaele Sanzio) of Urbino. Italian painter. *Sistine Madonna*. Among his other works are the frescoes called *The School of Athens*, *The Transfiguration*, *The Marriage of the Virgin*, *Galatea*, and the cartoons (designs for tapestry of the Pope's Chapel). Born, 1483; died, 1520.
- Read**, Thomas Buchanan. American poet and artist. *The Wagoner of the Alleghanies*. Born, 1822; died, 1872.
- Reed**, Thomas B. Distinguished American Congressman and Speaker of the House. A public speaker of note. Born, 1839.
- Renan**, J. Ernest. French Orientalist and author. *Life of Jesus*. Born, 1823; died, 1892.
- Revere**, Paul. American Revolutionary patriot. Carried to Concord news of impending attack of Gage. Born, 1735; died, 1818.
- Reynolds**, Sir Joshua. English painter. *Mrs. Siddons as the Tragic Muse*. Born, 1723; died, 1792.
- Rhodes**, Cecil John. English adventurer. He became chief owner of the South African diamond mines; Prime Minister of Cape Colony in 1890; and chief settler of "Rhodesia." Was accused of fomenting the war with the Transvaal; projected a railroad from Cape Town to Cairo. Born, 1853.
- Richard I.** (Cœur de Lion.) King of England. Conquered Acre; defeated Saladin. Born, 1157; died, 1199.
- Richard III.** King of England. Put Edward V. to death and usurped his crown; killed at Bosworth. Born, 1452; died, 1485.
- Richardson**, Samuel. English novelist. *Clarissa Harlowe*, *Sir Charles Grandison*, *Pamela*. Born, 1689; died, 1761.
- Richelieu**, Armand Jean Duplessis, Cardinal. French statesman. Made Cardinal, 1622; Prime Minister, 1624; secured exile of his foe, Marie de Medicis, 1630; reduced the Huguenots and captured Rochelle; supported German Protestants against Austria; founded French Academy (1635); added Alsace, Lorraine, and Roussillon to France. Born, 1585; died, 1642.
- Richter**, John Paul Frederick (Jean Paul). German novelist. *Thorn, Fruit, and Flower Pieces*. Born, 1763; died, 1825.
- Rienzi**, Nicolo Gabrini. Italian patriot and enthusiast. Tribune; for a short time ruler of Rome: "the friend of Petrarch, hope of Italy." Born, 1313; died, 1354.
- Roberts**, Lord Frederick. The hero of Kandahar (1880). Commander-in-chief of British forces in Boer War, South Africa, 1899-1900. Succeeded Lord Wolseley as commander-in-chief, and was made an earl. Born, 1832.
- Robert I.** (Bruce.) King of Scotland. Conquered Scotland from the English. Born, 1276; died, 1329.
- Robespierre**, Francois J. M. French Revolutionist. Leader of the extreme radicals; ruler during the Reign of Terror; guillotined. Born, 1759; died, 1794.
- Rosebery**, Archibald Philip Primrose, Earl of. English statesman; Prime Minister, 1894-1895. Born, 1847.
- Roentgen**, William Konrad von. German physicist. He discovered in 1895 the X-rays or Roentgen-rays. Born, 1845.
- Rockefeller**, John D. American capitalist; President Standard Oil Company. A man of immense wealth; gave largely to Chicago University. Born, 1840.
- Roland**, Madame Manon J. P. French Republican and writer. *Memoirs*. Guillotined. Born, 1754; died, 1793.
- Roosevelt**, Theodore. Vice-President of the United States with McKinley. Graduated Harvard, 1880; entered New York Legislature, 1882; appointed head of Civil Service Commission by President Harrison, 1889, and again by Cleveland, 1893; Commissioner Police in New York, 1895; Assistant Secretary of Navy, 1897; Hero "Rough Riders" Spanish War, 1898; Governor of New York, 1899; elected Vice-President, 1900. Born, 1858.
- Rothschild**, Meyer Amschel. Famous banker.

- The founder of the Rothschild house, born at Frankfort-on-the-Main, a Jew by birth; began his career as a money lender and made a large fortune. Born, 1743; died, 1812.
- Rubens, Peter Paul.** Dutch painter. *Descent from the Cross, Last Judgment, Battle of the Amazons, Judgment of Paris, Rape of the Sabines.* Born, 1577; died, 1646.
- Ruskin, John.** English art critic. *Modern Painters.* Born, 1819; died, 1900.
- Salisbury, Robert Arthur Talbot Gascoigne Cecil,** Marquis of. English statesman. Entered the House of Lords as Lord Salisbury in 1867; became Secretary for Foreign Affairs in 1881, and, on the death of Beaconsfield, leader of the Conservative party; he was three times raised to the Premiership, the last time on Lord Roseberry's retirement in 1896. Born, 1830.
- Sampson, William T.** American Rear Admiral. Commanded United States fleets Atlantic squadron, during Spanish War. Born 1840.
- Savonarola, Girolamo.** Italian reformer. A Dominican monk and preacher; denounced the corruptions of the Church; deserted by his followers; put to death. Born, 1452; died, 1498.
- Schiller, John C. F. von.** German dramatist and poet. Studied law and medicine, but finally followed his own inclination to literature. *The Robbers, Thirty Years' War, Wattenstein, Mary Stuart, William Tell,* etc.
- Schley, Winfield Scott.** Rear Admiral American Navy. Rescued Greeley Expedition, 1884. Commanded in naval victory over Spanish fleet at Santiago, 1898. Born, 1839.
- Schubert, Francis.** German composer. His Songs (*Lieder*) and Ballads are his best work; musical, tender, and expressive in the rarest degree. Born, 1797; died, 1828.
- Schurz, Carl.** American journalist and politician. Secretary of the Interior, 1877-1881. Born, 1829.
- Scott, Sir Walter.** Scotch novelist, poet and historian. *Waverley* novels; *Marmion, Lay of the Last Minstrel, The Lady of the Lake, Rokeby, The Vision of Don Roderick.* Son of an Edinburgh writer to the signet; lived at Abbotsford; ruined by commercial speculation. Born, 1771; died, 1852.
- Scott, Winfield.** Eminent American general. Prominent service in the War of 1812 against the British; received gold medal from Congress, and was promoted to major-general; 1841, made commander-in-chief of the United States army; 1847, assumed command in Mexico; received surrender of the City of Mexico; defeated for presidency by Franklin Pierce; made lieutenant-general. Born, 1786; died, 1866.
- Selkirk, Alexander.** Scotch sailor. His adventures suggested *Robinson Crusoe.* Lived alone on Juan Fernandez, 1694-1709. Born, 1675; died, 1723.
- Seward, William H.** American Republican statesman. Secretary of State, 1861-69. Born, 1801; died, 1872.
- Shafter, William Rufus.** American General. Defeated Spanish General Torrel, and received sur-
- render of Spanish army at Santiago, Cuba, 1898. Born, 1835.
- Shakespeare, William.** Greatest English poet and dramatist. *Lear, Hamlet, Macbeth, Othello, The Tempest, Midsummer Night's Dream;* born at Stratford-on-Avon; married Anne Hathaway, 1582; produced the poems *Venus and Adonis*, and the *Rape of Lucrece*, 1593-94, the only works published under his own hand; first collected edition of works appeared in 1623. Born, 1564; died, 1616.
- Shelley, Percy Bysshe.** English poet. *Cenci, Adonais, Prometheus, Revolt of Islam, Alastor, The Witch of Atlas;* was drowned off coast of Italy. Born, 1792; died, 1822.
- Sheridan, Philip H.** American general. Won battles of Winchester, Cedar Creek, Five Forks. Born, 1831; died, 1888.
- Sherman, John.** American politician and financier. Secretary of the Treasury, 1877-81; Secretary of State, 1897-98. Born, 1823; died, 1900.
- Sherman, William Tecumseh.** American general. Made the "March to the Sea," through Georgia. Born, 1820; died, 1891.
- Sickles, Daniel Edgar.** American general. Elected to Congress 1856; brigadier-general in Civil War, losing a leg at Gettysburg; Minister to Spain, 1869-73. In Congress, 1892-94. Born, 1822; died, 1901.
- Simon, Jules.** French statesman and author of numerous works. Born, 1841; died, 1896.
- Smiles, Samuel, LL. D.** Scotch editor and author. Among his books are *Self-Help, Character, Thrift, Life and Labor*, and the *Biographies of Inventors.* Born, 1816.
- Smith, Adam.** Scotch political economist. *Wealth of Nations.* Born, 1723; died, 1790.
- Smith, Joseph.** Founder of the Mormon Church. Claimed to dictate the *Book of Mormon* from gold plates found in New York State; arrested and imprisoned in the jail at Carthage, Mo., where he was killed by a mob. Born, 1805; died, 1844.
- Smith, John, Captain.** English adventurer. Famous Governor of Colony of Virginia. *History of Virginia.* Born, 1579; died, 1631.
- Smith, Sydney, Rev.** English divine and wit. Projector of the *Edinburgh Review, Peter Plymley's Letters.* Born, 1771; died, 1845.
- Socrates.** Athenian philosopher. Teacher of Plato. Put to death for his radical opinions. Born, B. C. 468; died, 399.
- Southey, Robert,** English poet laureate. *Curse of Kehama, Madoc, Thalaba, Don Roderick.* Born, 1774; died, 1843.
- Spencer, Herbert.** English philosopher. *System of Evolutionary Philosophy.* Born, 1820.
- Spinoza, Benedict.** Dutch philosopher. *Ethics Demonstrated by a Geometric Method.* Born, 1632; died, 1677.
- Stael, Anna M. L. G., Baroness de.** French authoress. Opposed Napoleon and was banished. *Corinne.* Born, 1766; died, 1817.
- Standish, Miles, Captain.** Plymouth colonist and soldier. Born, 1584; died, 1656.
- Stanley, Henry Morton.** African explorer. Born in Wales; went as a boy to America; became a

- newspaper correspondent; in 1869 was sent by the New York *Herald* to Africa to "find Livingstone;" succeeded in 1871. Wrote *The Congo*, *In Darkest Africa*, etc. Born, 1841.
- Stanton, Edwin McMasters.** American statesman. Attorney-General of the United States under Buchanan; Secretary of War under Presidents Lincoln and Johnson. Became a Justice of the Supreme Court of the United States, 1869. Born, 1815; died, 1869.
- Stanton, Elizabeth Cady.** One of the first agitators of woman's rights in the United States, and a leading advocate, lecturer, and writer on this subject and other reforms. Born, 1816.
- Stedman, Edmund Clarence.** American poet, and banker. Aside from his original compositions, edited *Victorian Poets*, *American Poets*, *Library of American Literature*. Born, 1833.
- Stevens, Alexander H.** American statesman. Vice-President of the Southern Confederacy. Born, 1812; died, 1883.
- Stephenson, George.** English inventor of the locomotive. In 1814 constructed a locomotive which drew eight cars; invented the steam blast pipe, and greatly improved the construction of the railroad; finally built an engine running thirty-five miles an hour. Born, 1781; died, 1848.
- Stephenson, Robert.** English inventor of the tubular bridge. Born, 1803; died, 1859.
- Sterne, Laurence.** English writer. *Tristram Shandy*, *Sentimental Journey*. Born, 1713; died, 1768.
- Stevenson, Robert Louis Balfour.** English novelist. *Treasure Island* (1883) won him fame; died in the Samoan Islands, where he made his home. Born, 1850; died, 1894.
- Stevenson, Adlai Ewing.** American statesman. Vice-President of the United States, 1893-97, with Grover Cleveland. Nominated again in 1900, with William Jennings Bryan, but failed of election. Born, 1835.
- Stewart, Alexander T.** American millionaire merchant. Born, 1803; died, 1876.
- Stockton, Francis Richard.** American novelist, and writer of humorous and fantastic tales. *Rudder Grange* and *The Lady or the Tiger?* Born, 1834.
- Story, Joseph.** American jurist. Justice of the Supreme Court. *Commentaries on the Constitution*. Born, 1779; died, 1845.
- Stowe, Harriet E. Beecher.** *Uncle Tom's Cabin*. Born, 1812; died, 1896.
- Strauss, David Friedrich.** German rationalist. Originator of the mythical theory of the Scriptures; Professor of Divinity at Zurich. Author of *The Life of Jesus*, which caused a great sensation by its skepticism. Born, 1808; died, 1874.
- Stuart, Gilbert C.** American portrait painter. *Portrait of George Washington*. Born, 1756; died, 1828.
- Sullivan, Sir Arthur.** Noted English musical composer. Author of *Pinafore Pirates of Penzance*, and *Patience*. Born, 1844; died, 1900.
- Sumner, Charles.** American Republican statesman, orator, and Senator. *The Grandeur of Nations*. Born, 1811; died, 1874.
- Swedenborg, Emanuel.** Swedish religionist and naturalist. The central point of his theosophy is the correspondence of the natural and the supernatural. Born, 1689; died, 1772.
- Swift, Jonathan.** Irish divine and satirist. Entered Church; became Dean of St. Patrick's; *Tale of a Tub*, *Gulliver's Travels*. Born, 1667; died, 1745.
- Talleyrand Perigord, Charles Maurice, Prince of.** French diplomatist and wit. Minister of Foreign Affairs. Born, 1754; died, 1836.
- Taney, Roger B.** American jurist and Democratic statesman. Chief Justice of the United States. Born, 1777; died, 1864.
- Taylor, Bayard.** American traveler, novelist, poet. Translator of Goethe's *Faust*; *Prince Deucalion*; *Masque of the Gods*; *John Godfrey's Fortunes*. Born, 1825; died, 1878.
- Taylor, Zachary.** American President. Entered army in 1808; major-general in Mexican War; won battle of Buena Vista; elected President by the Whigs in 1848. Born, 1784; died, 1850.
- Temple, Sir William.** English statesman and author. Negotiated the Triple Alliance of 1668. Born, 1628; died, 1699.
- Tennyson, Alfred.** English poet. Educated at Cambridge; made poet-laureate in 1850. *In Memoriam*, *Enoch Arden*, *The Princess*, *Maud*, *The Idylls of the King*, *Queen Mary*, *Harold*. Born, 1809; died, 1893.
- Tesla, Nikola.** American electrician of Servian birth. He made remarkable experiments with currents of high frequency, and invented useful electrical devices. Born, 1857.
- Thackeray, William Makepeace.** English novelist; born in Calcutta. *Henry Esmond*, *Vanity Fair*, *The Newcomes*, *Tendennis*, *The Four Georges*, *English Humorists*. Born, 1811; died, 1863.
- Thiers, Louis Adolphe.** First President of the French Republic (1871-73.) *History of the Consulate and Empire*. Born, 1797; died, 1877.
- Thomas, George H.** American Federal general. Saved army at Chickamauga; won battle of Nashville. Born, 1816; died, 1870.
- Thompson, Sir John S. O.** Canadian jurist. Attorney-General and Minister of Justice (1885); Premier of Canada (1893). Born, 1844; died, 1894.
- Thomson, James.** Scotch poet. *The Seasons*, *The Castle of Indolence*, *Tancred and Sigismunda*. Born, 1700; died, 1748.
- Thoreau, Henry D.** American author. *The Concord and Merrimac Rivers*, *The Maine Woods*. Born, 1817; died, 1862.
- Thorwaldsen, Albert D.** Danish sculptor. *Triumphal March of Alexander*, *Statues of Christ and His Apostles*. Born, 1770; died, 1844.
- Tindale, William.** English reformer and martyr. Translated the New Testament into English. Was strangled and burned at the stake for heresy. Born, 1480; died, 1536.
- Tilden, Samuel J.** American Democratic statesman. Candidate for President in 1876. Born 1814; died, 1885.
- Titian.** (Tiziano Vecelli.) Italian painter. Among his masterpieces are the *Assumption of the Virgin*, *Presentation of the Virgin*, *The Last Supper*. Born, 1477; died, 1566.

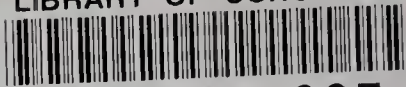
- Tocqueville**, Alexis C. H. C. de. French author. *American Democracy*. Born, 1805; died, 1859.
- Tolstoi**, Count Leo. Russian writer and social reformer. Famous as a poet and novelist; devoted himself to remedy the ills of poverty; living and toiling like a peasant. In 1901 he was banished from Russia on account of his radical teachings. *War and Peace*, *Anna Karenina*, *The Kreutzer Sonata*, etc. Born, 1828.
- Toombs**, Robert. American statesman. United States Senate, 1853-59; leader of Georgia secessionists. Born, 1810; died, 1885.
- Torricelli**, Evangelista. Italian physicist. Inventor of the barometer. Born, 1608; died, 1647.
- Toussaint l'Ouverture**, Francois. Negro chief of the Haytien Rebellion. Born, 1743; died, 1803.
- Trollope**, Anthony. English novelist. *Barchester Towers*. Born, 1815; died, 1882.
- Trowbridge**, John Townsend. American author, poet, and juvenile writer. *Coupon Bonds* and *The Vagabonds* are his best known productions. Born, 1827.
- Tupper**, Sir Charles. A Canadian statesman. Served in several ministerial offices, and as Lord High Commissioner in London; Premier (1896). Born, 1821.
- Turner**, Joseph M. W. English painter. *The Slave Ship*. Born, 1775; died, 1851.
- Tweed**, William Marcy. Famous Tammany "boss" in New York City. Convicted of fraud and imprisoned; escaped to Spain, but was sent back, and died in prison. Born, 1823; died, 1878.
- Tyler**, John. American President. Born in Virginia; practiced law; M. C. 1816-21; Governor of Virginia 1825; elected U. S. Senator 1827; resigned 1836; elected Vice-President on Whig ticket 1840; succeeded Harrison on his death in 1841. Born, 1790; died, 1862.
- Tyndall**, John. English physicist. *Heat Considered as a Mode of Motion*. Born, 1820; died, 1893. Attorney-General of New York 1815; leading man of the "Albany Regency;"
- Van Buren**, Martin. American President. Entered bar 1803; elected U. S. Senator by the Democrats 1821; Governor of New York 1828; Secretary of State 1829-31; Vice-President 1833-37; President 1837-41. Born, 1782; died, 1862.
- Vandyke**, Sir Anthony. Flemish painter in England. Pupil of Rubens; settled in England in 1632, among his best works are *The Erection of the Cross*, *Portrait of the Earl of Strafford*, and a *Crucifixion*. Born, 1599; died, 1641.
- Van Rensselaer**, Stephen. American statesman and landholder. *The Patroon*. Founder of the Rensselaer Institute. Born, 1764; died, 1839.
- Vancouver**, George. English navigator. Discoverer of Vancouver's Island. Born, 1758; died, 1798.
- Vanderbilt**, Cornelius. American capitalist. Founder of the Vanderbilt family and fortune. Born, 1794; died, 1877.
- Vane**, Sir Henry. English painter. Statesman; leader of independents; head of navy; beheaded. Born, 1612; died, 1662.
- Verdi**, Giuseppe. Italian musical composer and Senator. Among his productions are *Ernani*, *La Traviata*, *Il Trovatore*, *Montezuma*, and *Aida*. Born, 1814; died, 1901.
- Vespucius**, Americus. Italian navigator. America was named after him. Born, 1451; died, 1512.
- Victor**, Emmanuel II. King of Sardinia; first King of Italy; restorer of Italian unity. Born, 1820; died, 1878.
- Victor**, Emmanuel III. King of Italy. Succeeded to the throne in 1900, on the assassination of his father, Humbert I. Born, 1869.
- Voltaire**, Francois M. Arouet de. French philosopher, poet, historian, wit, skeptic. Passed the years 1750-53 with Frederick the Great; took up his residence (1755) at Ferney; *The Age of Louis XIV.*, *Essay on the Manners of Nations*, and *Candide*. Born, 1694; died, 1778.
- Wade**, Benjamin F. American politician. Republican Senator from Ohio; Abolitionist. Born, 1800; died, 1878.
- Wagner**, Richard. German composer. *Lohengrin*, *Gotterdammerung*, *Tannhauser*, *Rheingold*, *Nibelungenlied*; produced *Parsifal* at Bayreuth, 1882. Born, 1813; died, 1883.
- Wainwright**, Richard. U. S. naval officer. Executive officer of the battleship *Maine*, blown up in Havana harbor; commander of the *Gloucester*, battle of Santiago, 1898. Born, 1849.
- Wales**, Albert Edward. Eldest son of Queen Victoria. Became King of England on the death of his mother, January, 1901, under the title of Edward VII. Born, 1841.
- Wallace**, Lewis. An American soldier and novelist. General in the Civil War; wrote *Ben Hur*, *The Prince of India*, etc. Born, 1827.
- Wallace**, Sir William. Scotch patriot and general. Fought Edward I. of England; executed. Born, 1270; died, 1305.
- Wallenstein**, Albert, Count of, German general. Opponent of Gustavus Adolphus, by whom he was defeated, 1632; in 1634 he was deprived of his command and assassinated. Born, 1583; died, 1634.
- Walton**, Izaak. English writer. *The Complete Angler*. Born, 1593; died, 1683.
- Wanamaker**, John. An American merchant. Originator of the department store idea; Postmaster-General 1889-93. Born, 1838.
- Ward**, Mrs. Humphrey. English novelist. Granddaughter of Dr. Arnold, of Rugby. *Robert Elsmere*, *Marcella*, etc. Born, 1851.
- Warner**, Charles Dudley. American humorist and essayist. *Summer in a Garden*, *Back-log Studies*, *Washington Irving* (1881), *Captain John Smith*, *In the Levant*. Born, 1828; died, 1900.
- Washington**, George. Commander-in-chief in the American Revolution. First President of the United States; aide-de-camp to Braddock in the Indian campaign of 1755; married Martha Custis, 1759; chosen to Congress, 1774; appointed Commander-in-chief, 1775; President, 1789-97. Born, 1732; died, 1799.
- Watt**, James. Scotch inventor. Principal inventor of the steam engine; used the expansive force of

- steam to depress a piston; improved engines for pumping water. Born, 1736; died, 1819.
- Webster, Daniel.** American lawyer, orator, and statesman. Greatest legal effort was the Dartmouth College case; greatest Congressional speech was his reply to Hayne. Born, 1782; died, 1852.
- Webster, Noah.** American lexicographer. *Dictionary of the English Language*. Born, 1758; died, 1843.
- Wedgewood, Josiah.** English potter. Originator and maker of the famous "Wedgewood" ware. Born, 1730; died, 1795.
- Wellington, Arthur Wellesley.** Duke of. British general and statesman. General in India; was made commander-in-chief in Spain and Portugal; fought the battles of Talavera, Sabagal, and Albuera; captured Badajos, 1812; won at Waterloo, 1815; was afterward Prime Minister and Minister of Foreign Affairs. Born, 1769; died, 1852.
- Wesley, Charles, Rev.** English poet and divine. *Hymns*. Born, 1708; died, 1788.
- Wesley, John.** Founder of the Methodist Wesleyans. Born, 1703; died, 1791.
- West, Benjamin.** American painter in England. *The Death of Wolfe, Death on the Pale Horse*. Born, 1738; died, 1820.
- Westinghouse, George.** American inventor. Famous for inventing the Westinghouse air-brake. Born, 1846.
- Wheeler, Joseph.** American soldier. Graduated at West Point in 1859; entered Confederate service in Civil War; entered Congress, 1881; took part in the Santiago campaign in Cuba in 1898; served in the Philippines in 1899; appointed brigadier-general in U. S. army. Born, 1836.
- Whitefield, George, Rev.** English Methodist preacher and revivalist. Born, 1714; died, 1770.
- Whitney, Eli.** American inventor. The cotton-gin. Born, 1765; died, 1825.
- Whittier, John Greenleaf.** American poet, farmer, shoemaker, journalist, anti-slavery agitator. *Snow-Bound, Voices of Freedom, Home Ballads, In War Time, The Tent on the Beach*. Born, 1808; died, 1893.
- Whitman, Walt.** American poet. Editor, carpenter, nurse, government clerk. *Leaves of Grass, The Two Rivulets, Drum Taps, Democratic Vistas*. Born, 1819; died, 1892.
- Wilberforce, William.** English philanthropist, statesman, and reformer. Secured abolition of slave trade. Born, 1759; died, 1833.
- Willard, Frances Elizabeth.** American temperance reformer and lecturer. Founder of the World's W. T. C. U., and its first president; author of several reformatory works. Born, 1839; died, 1898.
- William I.** Seventh King of Prussia, and first German Emperor. He succeeded to the throne in 1861, and was crowned Emperor in 1871, on the formation of the German Empire after the Franco-Prussian War. Born, 1797; died, 1888.
- William II.** Emperor of Germany. Son of Frederick, the second Emperor, whom he succeeded in 1888. Born, 1859.
- Williams, Roger.** Founder of Rhode Island Colony. Born, 1606; died, 1683.
- Winthrop, John.** Governor and founder of the Massachusetts Bay Colony. Born, 1588; died, 1649.
- Wolsey, Thomas, Cardinal.** English statesman. Chancellor of Henry VIII.; secured Henry's divorce from Catherine. Born, 1471; died, 1530.
- Worcester, J. E.** American lexicographer. *Dictionary*. Born, 1734; died, 1866.
- Wordsworth, William.** English poet. Educated at Cambridge; with Coleridge produced *Lyrical Ballads*, 1798; settled at Rydal Mount, 1803; published *Poems*, 1807; *The Excursion*, 1814. Among his other works are *Ecclesiastical Sonnets, The Wagoner, Yarrow Revisited, The Prelude*. Born, 1770; died, 1850.
- Wren, Sir Christopher.** English architect. St. Paul's Cathedral. Born, 1632; died, 1723.
- Wycliffe, John de.** English reformer. Translator of the Scriptures. Born, 1324; died, 1384.
- Xavier, Francis, Saint.** "Apostle of the Indies." Jesuit missionary to India and Japan. Born, 1506; died, 1552.
- Xerxes I.** King of Persia. Invader of Greece; beaten at Salamis. Born, B. C. —; died, 465.
- Yale, Elihu.** Founder of Yale College. Born, 1648; died, 1721.
- Yonge, Charlotte.** A well-known author, writer of novels, and children's books and histories. *The Heir of Redclyffe, Cameos of History of England*. Born, 1823; died, 1901.
- Young, Brigham.** American religionist. Head of the Mormons. Born, 1801; died, 1877.
- Young, Edward.** English poet. Rector of Welwyn, in Hertfordshire. *Night Thoughts, The Revenge, The Love of Fame*. Born, 1684; died, 1756.
- Zenobia, Septimia.** Queen of Palmyra (266-73.) Her dominions extended from the Mediterranean to the Euphrates, and included a large part of Asia Minor. She refused allegiance to Aurelian, who defeated her and captured Palmyra; passed the rest of her life at Tibur, in Italy. Born, —; died, 275.
- Zeuxis.** Greek painter. *The Infant Hercules Strangling a Serpent*. Flourished B. C. 5th century.
- Zinzendorf, Nicholas Louis, Count of.** Founder of the Moravians. *The Journey of Atticus Through the World*. Born, 1700; died, 1760.
- Ziska, John.** Hussite chief. Beat Imperial armies thirteen times. Born, 1360; died, 1424.
- Zola, Emile.** French novelist. Wrote *Contes a Ninon* and other collections of short stories, and a large number of realistic novels. Among the latest are *Lourdes, Rome, and Paris*. Born, 1840.
- Zoroaster.** A Persian philosopher. Distinguished as the founder of the Magian religion. 1500 to 200 B. C.
- Zwingli, Ulric.** Swiss reformer. *Exposition of the Christian Faith*. Killed in battle. Born 1484; died, 1531.
- Zwirner, Ernst Friedrich.** German architect. Completed Cathedral of Cologne; built many castles on the Rhine, famed for their beauty. Born, 1802; died, 1861.

SEP 5 1901

Sept 18 1901

LIBRARY OF CONGRESS



0 020 519 885 4